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Simplification of Traffic Records for Purposes of Comparison

By Major W. W. Crosby, Chief Engineer to the State Roads Commission, Baltimore, Md.

IN 1903 the writer publicly suggested the advisability of obtaining and recording the important facts concerning the traffic over streets and roads so that a better basis might be had by highway engineers for the solution of many of the then existing problems, and of new questions that it seemed to him probable would arise in the near future. He began to accumulate such records in 1904, and has continued this work as his opportunities permitted. Others have also worked along similar lines, and valuable publications of their work have been made, notably in the cases of Fletcher of Massachusetts; Blanchard of Rhode Island, and Bishop & Armstrong of New York.

In endeavoring to compare traffic records, even when made on identical or similar lines, the writer has been impressed with the amount of labor involved when the written or printed records are spread before one, and with the utter hopelessness now of making a mental comparison when listening to verbal expressions of the records.

The writer suggested the point at a recent meeting of the American Society of Civil Engineers, when a number of traffic records were stated by various speakers and the confusion in the minds of the hearers was apparent, but was at that time unprepared to go further into the subject. He therefore now submits the following for such consideration and discussion as may be had, with the hope that both may be full and that the results may be beneficial to all interested.

Let it be assumed that the road surface is ideal, so far as its construction goes, and that its drainage and foundation are proper in every respect. There will be three agencies of traffic which may destroy it:

A. The shocks of the feet of horses or of the hard tires of vehicles.

B. The crushing effect of loads exceeding a (variable) maximum per unit area of tire.

C. The shearing action of automobile traffic.

A. In the present form of traffic census, count is had (and sometimes reduced to an average-per-hour) of

Led or ridden horses.
Vehicles drawn by single horses.*
Vehicles drawn by two sorses.*
Vehicles drawn by three horses.
Vehicles drawn by four horses.
Vehicles drawn by five horses.
Vehicles drawn by six horses.
Etc.

*Sometimes these items are each subdivided into two classes—"light" and "heavy."

In order to reduce these separate factors to a common denominator, for the purpose of combining them, we may safely start by assigning to the led or ridden horse the value of "one."

To the vehicle and the single horse drawing it, perhaps in many cases (such as all pleasure traffic of this character) no greater value should be assigned. To some commercial outfits, but slightly more would probably be fair. However, as in many cases single carts, heavily loaded, considering the frequent narrowness of their metal tires, will be included in the count, it seems well to the writer to assign a value of "two" to this item. (It may have already been noted, as it should be, that no distinction has been made in the record between light and loaded vehicles, and this omission, the writer thinks, is

proper at present, at least, and desirable for the sake of convenience and simplicity.)

For the two-horse vehicle, the value of "four" seems to the writer fair, after careful consideration. And he can see no good reason why a value equal to double the number of the horses should not be taken for each

Motorcycles 2
Runabouts of all kinds (including taxicabs, broughams, etc.).....10
4 or 5-seat touring cars.....20
6 or 7-seat cars, limousines, landaulets, etc.....40
Drays 20

Figured thus:

Items.	Weight in Lbs.	Speed Miles pr. Hr.	Product.	Unit Assumed.
Motorcycles	200	40	8,000	2
Runabouts	2,000	20	40,000	10
4 or 5-seat cars.....	3,000	25-30	80,000	20
6 or 7-seat cars.....	4,500	35	157,500	40
Drays 12,000		6-7	84,000	20

of the succeeding items in the census of horse-drawn vehicles, at least until experience shall have proved this assumption to be too wide of the mark.

B. The writer has, on a number of occasions in the past, publicly referred in detail to this item, and will not repeat his remarks here. Suffice it to say that, in his judgment, sufficient consideration for all ordinary purposes has been given in the foregoing. For extraordinary cases it will be necessary to consider the item separately and with particular care. It seems advisable to record the data, but, except in extraordinary cases, to omit reference to "B" in comparisons of traffic censuses.

C. The shearing strains set up by automobiles vary directly with the momentum, or practically with the products of the weights by the speeds. A weight for various cars is, for practical purposes, easy of assumption. The speed may never be twice alike and is never easy of determination. An assumption may be made for our purposes, and to be proved or disproved as fair by future observations. Such an assumption should be on the facts that ordinary motor traffic at speeds under fifteen miles per hour does little, if any, damage to the road surface; that the probabilities for speed vary largely with the type of car; that abilities or proclivities for speed are, more than speed regulations, to be considered in this connection; and that it is now probably advisable rather to assign too high a value than one too low in the search for the "common denominator" in this problem.

The writer would therefore suggest the assignment of values to motor traffic records, considering those adopted for horse-drawn traffic, as follows:

The last item may seem to many to have been given too low a value. It should, however, be remembered that in addition to their usual low speed and resilient tires, the latter are usually of great width.

Further, their effect, the writer believes, is more for consideration in connection with details of foundation than of the road surface, a separate matter.

No note is made of traction engines. These and motor trucks should be considered under "B," and in matters of foundation.

For illustration, now, may be taken one or two recent records of traffic censuses.

On Park Heights avenue, just out side of Baltimore, the count in November, 1910, was as follows:

7 a. m. to 7 p. m.

Led or ridden horses..... 30
Single horse vehicles.....245
Double horse vehicles.....104
Three horse vehicles..... 10
Four horse vehicles..... 14
Six horse vehicles..... 1
Motorcycles 8
Runabouts 26
4 or 5-seat cars.....141
6 or 7-seat cars..... 66
Motor trucks..... 4

The count in November, 1910, on the Baltimore-Washington road was:

8 a. m. to 7 p. m.

Led or ridden horses..... 0
Single horse vehicles.....255
Double horse vehicles..... 67
Three horse vehicles..... 4
Four horse vehicles..... 2
Five horse vehicles..... 0
Six horse vehicles..... 0
Motorcycles 10
Runabouts 5
4 or 5-seat cars..... 36

6 or 7-seat cars	7
Motor trucks	3

And in January, 1911, on the Easton-Wye Mills road:

7 a. m. to 7 p. m.	
Led or ridden horses	0
Single horse vehicles	197
Double horse vehicles	70
Three horse vehicles	0
Four horse vehicles	0
Five horse vehicles	0
Six horse vehicles	0
Motorcycles	1
Runabouts	4
4 or 5-seat cars	2
6 or 7-seat cars	0
Motor trucks	0

This road was built of water-bound macadam and completed in May, 1910, but demanded surface treatment with pitch in August, 1910.

Note the space required for this form of report and the confusion to a reader even, not to mention a listener, when condensed into Table I.

How can further condensation be had for simplicity in comparison?

By applying the suggested values to each item, Table II results.

Which form is preferable?

The New York state authorities have done considerable work, the writer believes, along the lines of the foregoing, and he has examined their work to some extent. Such information as he has, however, fails to convince him of the propriety of some of the factors used by them, although he must admit he has not much physical proof of the incorrectness of the factors referred to.

In 1904 a traffic count gave Table III on Park Heights avenue, reduced to the hour basis.

Now, in 1904, the road had been thoroughly resurfaced with water-bound trap rock macadam.

Until about 1908 it sustained the traffic very satisfactorily, but suddenly it seemed to demand resurfacing (which was begun in 1909) because of the surface condition, which was easily recognizable as due mainly to motor traffic damage. The surface became badly raveled and pitted. It is probable that between 1904 and 1908 the motor traffic rapidly increased, not only in amount but somewhat in its proportion to the whole traffic, though the horse traffic has also considerably increased. The writer has had the local conditions under constant observation, and it is his opinion that the New York units have been proved not to represent the relative values of the different items as well as those suggested by the writer.

Another illustration may perhaps be found in the case of the Easton-Wye Mills road, whose treatment on account of damages by motor traffic was demanded within three months after its completion with water-bound limestone macadam in 1910. Table IV.

TABLE I—TRAFFIC CENSUSES—OLD FORM OF RECORD.

Items.	Park Heights Avenue Section 1.	Baltimore-Washington Road Section **	Boston-Wye Mills Road *
Led or ridden horses	30	0	0
Single horse vehicles	245	255	197
Double horse vehicles	104	67	70
Three horse vehicles	10	4	0
Four horse vehicles	14	2	0
Five horse vehicles	0	0	0
Six horse vehicles	1	0	0
Motorcycles	8	10	1
Runabouts	26	5	4
4 or 5-seat cars	141	36	2
6 or 7-seat cars	66	7	0
Motor trucks	4	3	0

*7 a. m. to 7 p. m. **8 a. m. to 7 p. m.

TABLE II—COMPARISON OF TRAFFIC—NEW FORM OF RECORD.

Items.	Park Heights Avenue City End.	Baltimore-Washington Road City End.	Easton-Wye Mills Road Just Outside of Boston.	Remarks.
Horse traffic	93	74	56	Figures are reduced to hour basis.
Motor traffic	484	104	10	
Totals	577	178	66	

TABLE III—COMPARISON OF NEW YORK AND CROSBY FACTORS, PARK HEIGHTS AVE.

Items.	Number.	New York Factor.	Units Prod.	Writer's Factor.	Units Prod.
Led or ridden horses	3	1	3	1	3
Single horse vehicles	28	2½	70	2	56
Double horse vehicles	10	3½	35	4	40
Three horse vehicles	1	5	5	6	6
Four horse vehicles	1	6	6	8	8
Five horse vehicles	0	0	0	10	0
Six horse vehicles	0	8	0	12	0
			119		113
Motorcycles	2	1	2	2	4
Runabouts	1	2	2	10	10
4 or 5-seat cars	10	4	40	20	200
6 or 7-seat cars	5	7	35	40	200
Motor trucks	1	10	10	20	20
			89		434

TABLE IV—TRAFFIC CENSUS AND UNITS—EASTON-WYE MILLS ROAD.

Items.	No.	New York Factor.	New York Units.	Writer's Factor.	Writer's Units.	Remarks.
Single horse vehicles	197	2½	493	2	394	Count covers
Double horse vehicles	70	3½	245	4	280	12 hours.
			738		674	
Motorcycles	1	1	1	2	2	Motor traffic
Runabouts	4	2	8	10	40	probably at
4 or 5-seat cars	2	4½	9	20	40	minimum of year.
			18		82	

The writer believes that if some such system as is outlined above can be generally tried for a period of a few years, it can be worked out to confer a great practical benefit.

The Municipal Asphalt Paving Plant at Detroit, Mich.

By Len G. Shaw, Highland Park, Mich.

IT is seven years since Detroit installed its own asphalt plant, and in a modest way began patching streets where the original guarantees had expired, together with a little resurfacing. To the present time the city has saved in this quarter alone $174,866.18, according to the report of Asphalt Expert Clarence A. Proctor, as submitted to Commissioner of Public Works Jacob J. Haarer. The report covers in detail the operations of the plant during this term, and provides interesting reading matter, particularly in the light of the fact that the Detroit plant was one of the first municipally owned enterprises of this nature in the country, and that from an humble beginning it has grown until now all asphalt paving in Detroit is cared for in this manner.

In setting about determining the saving to the city through the operations of the municipal plant, Expert Proctor pursued a very conservative course. The basis of his calculations was the lowest average contract price for work of this nature in Detroit during the first five years the plant was in operation. Figuring the yardage laid by the city on this basis, it was an easy matter to discover the difference between what would have been paid had the work been done in this manner and what it actually cost under municipal operation, proper allowance being made for maintenance, depreciation of plant and other items

that must enter into the calculations if there is to be a fair determination of what has been accomplished. Ten per cent was charged off to depreciation, every other bit of overhead expense was taken care of, labor and material accounted for, liberal allowance made for maintenance, and it was found that on the 1,089,908.23 square yards of pavement dealt with in the report the city had saved exactly $174,866.18, an average of approximately $25,000 per annum since the installation of the plant.

Of course, the saving each year varies, in part according to the amount of work done, although there are other factors that must be taken into consideration, such as increased cost of material and labor. It is worthy of note in this connection that when the municipal asphalt plant was installed asphalt was selling at $22 a ton. Last year the city paid $31.60 per ton, an increase of forty per cent. While the advance in this respect over the figures prevailing during the period when the average contract price was determined has not been quite so pronounced, it is sufficient to show that the average taken in making the computation was well below what the actual cost would have been under contract. During 1910 the city laid 262,964.78 square yards of asphalt, this including paving, repaving, surfacing and patching. This was 10,000 yards more than the plant had ever handled in a single season, and on this work the city saved $41,525.68, the same basis of comparison being used in determining the saving that was employed in determining the saving for seven years.

There has been no attempt on the part of Commissioner Haarer to shut off competition from outside sources. Bids are asked, but the plant has proved so economical in operation that asphalt contractors not only find themselves unable to compete, but have even employed the city to take care of maintenance on streets where their original guarantee has not expired, this proving cheaper than moving a plant and equipment here for the small amount of maintenance that has to be taken care of each year.

The city lays no foundations, nor does it set the curbing on new streets, this being done by contractors under a competitive system. But it does handle all the asphalt paving, repaving and resurfacing, as well as the patching.

It is of interest at this point to note that although liberal provision is made for maintenance on streets laid by the city, the expense therefor has thus far been insignificant. Last year, for example, the total cost of maintenance on 1,089,908.23 square yards, exclusive of patching, on which there is no maintenance, was $251.23, this being based on the patching rate of $0.9313 cents a square yard. Of this amount $162.37 was used in patching a stretch where the trouble was of long standing, disintegration being caused by a leaky gas main, while the rest was spent chiefly on streets laid by the city that had been down seven years.

In determining the comparative cost of paving in Detroit and other municipalities the amount of material used plays an important part. Here more asphalt is used than some cities deem necessary. For repaving and resurfacing there is 1½-inch binder and 2 inches of topping compacted, while patching averages 3 inches, mostly topping, a very liberal allowance.

It will be noticed by reference to the appended tables that the city's profits from the asphalt plant have been considerably swelled as a result of patching done for contractors and private parties, such as public service corporations. In seven years 51,956.83 yards of pavement were laid in this manner, the amount received being $70,826.99. On a basis of $1.03584 per square yard, this work cost the city $53,819.11, leaving a net profit of $17,007.88. Another item of consequence in this connection was $26,453.53 received from contractors and from the park and boulevard commission for paving and repairing. On the 27,542.30 square yards of asphalt laid for the park and boulevard commission there was no allowance for maintenance, this being taken care of by the commission. The same is true of 18,116.56 square yards laid for contractors, who provide for the maintenance.

As it stands today the Detroit plant represents a capital investment of $53,114.81. It has a maximum capacity of 12½ miles a season, and so rapidly has the work increased that added equipment will shortly become necessary.

For the benefit of those interested in such matters, the detailed report of seven years' operation is given herewith, every item having been handled in full by Mr. Proctor and concurred in by Commissioner of Public Works Haarer:

EXPENDITURES, TABLE "A."

Capital expenditures—		
Buildings	$ 2,543.28	
Plant	24,702.55	
Portable plant	9,716.39	
Equipment	12,956.37	
Small tools	2,007.28	
Laboratory equipment, furniture	1,188.94	
Total capital expenditures		$53,114.81
Operating expenses—		
Salaries of expert and assistants	$25,174.51	
Sundry expense items	2,779.82	
Repairs and renewals	17,639.22	
Total operating expenses		$45,593.55
Total expenditures, except for material and labor at plant		$98,708.36

EXPENDITURES, TABLE "B."

Salaries of expert and assistants	$25,174.51	
Sundry expense items	2,779.82	
Repairs and renewals	17,639.22	
		$45,593.55
Less portion of salary of asphalt expert for years 1904-5-6 chargeable to inspection of contract work		3,500.00
		$42,093.55
Loss on sale of portable plant cost	$ 9,716.39	
Less depreciation, 2 years	1,943.28	
Sold for	5,000.00	
		$ 2,773.11
Estimated depreciation on capital expenditure on basis of 10 per cent. per annum—		
First year on $17,969.57	$ 1,796.96	
Second year on $25,923.81	2,592.38	
Third year on $35,238.97	3,523.90	
Fourth year on $42,404.85	4,240.49	
Fifth year on $45,720.72	4,572.07	
Sixth year on $46,846.47	4,684.65	
Seventh year on $48,114.81	4,811.48	
On orrowed equipment for 7 years	2,387.00	
		$28,608.93
Total expenses for 7 years		$73,475.59

CREDITS, TABLE "C."

Square yards of private patching and amount received for same—

Year.	Square Yds.	Amount Received.
1904	10,327.88	$10,241.73
1905	5,188.88	7,340.83
1906	6,162.78	9,170.78
1907	7,387.49	11,115.01
1908	11,055.79	16,009.28
1909	5,481.29	8,048.16
1910	6,352.72	8,901.20
Totals	51,956.83	$70,826.99

Cost to city, $1.03584 per sq. yd	53,819.11
Net profit to city	$17,007.88
Less demurrage, 1906	139.00
	$16,868.88
Sale of empty oil barrels gravel, use of roller, etc	2,608.07
Use of plant by contractors	200.00
Paving and repairing for contractors and park and boulevard commission	26,453.53
Sale of mixture to contractors for patching	379.00
Overage Venezuelan asphalt accounted for in former reports	160.03
Allowance for fittings to tank car, extra labor and unloading	28.90
Error in California oil charge, 1906	308.99
	$47,007.40

Cost per square yard—
Repaving and resurfacing, 1½-inch binder, 2 inches topping compacted. Patching average 3 inches, mostly topping.

	Square Yards.	Labor and Material.
Resurfacing	661,864.20	$0.86863
Paving-repaving	233,332.54	.86491
City and private patching	194,711.49	.9635
Total	1,089,908.23	

Overhead Charge, Table "B."	Total Cost, Exclusive of Maintenance.
.06735	$0.93598
.06735	.93226
.06735	1.03085

Total Cost 7 Years Production Exclusive of Maintenance.	Less Credits, Table "C."	Net Cost per Sq. Yd. Exclusive of Maintenance.
$ 619,492.46	$ 8,339.12	$0.9234
217,527.42	19,288.73	.8496
200,715.90	19,379.55	.9313
$1,037,735.78	$47,007.40	

Net Cost Exclusive Maintenance.	Ten Years Square Yards.	Maintenance Estim'd Reserve, 20c Sq. Yd.
$611,153.34	*634,321.90	$126,864.38
198,238.69	**215,215.98	43,043.20
181,336.35	†	
$990,728.38	849,537.88	$169,907.58

Total cost per square yard: resurfacing, $1.1105; paving-repaving, $1.0496; city and private patching, $0.9313.

*Difference 27,542.30 sq. yds. laid for park and boulevard commission, to be maintained by them.

**Difference 18,116.56 sq. yds. laid for contractors, to be maintained by them.

†No maintenance on patching.

Total Cost to City.	Lowest Average Contract Price.	Total Contract Price.	Estim'd Saving to City.
$ 738,017.72	$1.23	$ 814,092.97	$ 76,075.25
241,281.89	1.30	303,332.30	62,050.41
181,336.35	1.12	218,076.87	36,740.52
$1,160,635.96		$1,335,502.14	$174,866.18

Cement Concrete Street Paving in Mason City, Iowa*

By F. P. Wilson, City Engineer

THE past five or six years I have made a broad study of cement paving and have visited a large number of cities in the Northern States where this class of pavement has been laid, and I watched the methods of construction in detail for this class of pavements.

It is my opinion that a Portland cement concrete pavement, properly laid in an up-to-date manner with first-class cement, good clean, sharp sand, and good, clean, hard stone, with proper allowance made for expansion and contraction, certainly warrants the use of the same on account of its first cost, cheapness to maintain, the cleanliness of the streets, and the small expense to repair where it becomes necessary to cut holes.

During the summer of 1909 the city of Mason City, Iowa, laid six thousand square yards of cement paving in the down-town district, where it would have a test under the most severe traffic. At this time, after standing severe test of last winter and heavy traffic last year, also the cold of this winter to date, it is at this time, in as good a condition as the day it was finished.

The past season twenty-five thousand square yards were laid, and at this writing contracts have been let for forty-three thousand square yards, which this city expects to have laid this coming summer.

In constructing a first-class cement pavement, the first requirement is to have strictly first-class material; secondly, to have a first-class up-to-date set of plans and specifications and, lastly, a rigid and close following of those specifications in every detail.

The following are the detail specifications for Portland cement concrete pavement, which I have used in the construction of all concrete paving laid in Mason City, which has proven entirely satisfactory.

Preparation of Roadbed. All streets, prior to laying any pavement thereon, shall be graded that the pavements will be at the established grade when completed. After excavating to sub-grade, unless the Engineer deem the natural ground a proper foundation, excavation shall be continued until solid ground is reached and then refilled to sub-grade with sand, gravel or broken stone.

The contractor shall be required to remove at his own expense all obstructions, such as trees, old blocks, debris, etc.

Excavation. All excavated material, gutter stones, planks, macadam, crossing-stones, old curbs, surplus earth, etc., shall be the property of the city and be deposited by the contractor in such place and manner as shall be directed by the engineer, the distance not to exceed three thousand feet. No plowing will be allowed within three inches of the bottom of the foundation.

Rolling. When the street shall have have been graded and shaped to its proper form, it shall be thoroughly rolled with a ten-ton roller to a thoroughly compact surface. If the ground is wet, sand or gravel is to be put in before rolling.

Any depression discovered after this rolling, shall be re-filled to sub-grade, re-rolled, and this repeated until a roadbed, perfect as to grade and form, shall have been made.

Tamping. When the use of the roller is impracticable, the foundation must be thoroughly puddled and rammed until compacted to the satisfaction of the engineer.

Concrete Foundation. Upon the roadway thus formed, will be laid Portland cement concrete five inches thick, to be made as follows: one part by measure of Portland cement; two parts by measure of clean sharp sand, and five parts by measure of broken stone.

The sand and cement shall be thoroughly mixed dry, on a tight floor, and then made into mortar at the proper consistency and thoroughly mixed over with hose or shovels, or a batch mixer approved by the engineer. Broken stone, thoroughly cleaned of dirt, drenched with water but containing no loose water in the heap, shall then be added to the mortar in the proper proportion. The concrete will then be turned and mixed until each fragment is thoroughly coated with mortar, a strictly wet mixture being required. The concrete thus mixed shall have such a consistency that when rammed the mass will not

* A paper before the Iowa Engineers' Society.

shake like jelly, but will when struck, compact within the area of the face of the hammer without displacing the material laterally.

The concrete thus prepared shall be placed immediately in the work. It shall be spread and thoroughly compacted by ramming until free water appears on the surface, which shall be made smooth and parallel to the surface of the finished pavement. The whole operation of mixing and laying each batch of concrete shall be performed in an expeditious and workmanlike manner and be entirely completed before the cement has begun to set.

No re-tempering of concrete will be permitted, and concrete in which the mortar has begun to set will be rejected.

The thickness of this concrete to be five inches after the same has been compacted.

Extreme care should be taken that the sub-grade is kept moist while this concrete is being put in place.

No concrete shall be laid when the temperature at any time during the day or night falls below thirty-five degrees above zero, Fahrenheit.

Wearing Surface. Upon the concrete heretofore specified shall be immediately laid a wearing surface two inches in thickness to be made as follows: One part by measure of Portland cement, two parts by measure of coarse, clean, sharp sand; the sand and cement shall be thoroughly mixed dry, on a tight floor, and then made into mortar of the proper consistency and thoroughly mixed over with hose or shovels or a batch mixer approved by the engineer.

The mortar thus mixed will be immediately laid upon the concrete heretofore specified.

Before this mortar has begun to set it will be finished off to a smooth surface and corrugated according to the plans.

Corrugations. After the wearing surface has been completed the same shall be corrugated at an angle of ninety degrees with the curb, said corrugations to be nine inches apart. The corrugations to be three-eighths of an inch in depth and shall be formed with proper tools made for the purpose, and when the pavement is complete the corrugations shall present a slightly rounded upper edge so as to provide a firm and substantial foothold for the horses, no sharp corners to be left.

Where the street has a flat grade, the city council may, if they deem it advisable, omit the corrugations, and the wearing surface shall be finished with a wood float and before it has completely hardened it shall be roughened by brushing with a stiff vegetable brush or broom.

The curvature and cross sections of the pavement to be made according to the plans governing the same.

Requirements of Materials. The cement used in the work will be submitted to the tests approved and recommended by the American Society of Civil Engineers, which it must stand to the satisfaction of the engineer.

All Portland cement used in the work shall be Northwestern States Portland Cement or other Portland cement equally as good, which shall be protected from the weather, free from exposure to air slaking and from moisture until used.

The sand shall be clean, sharp sand.

The stone used for the concrete shall be of the best quality of hard limestone, or other stone equally as good, and shall be broken to such a size that the fragments shall not be larger than will pass through an inch and one-half ring and not smaller than a hazel nut. It shall be free from dust, dirt, loam or other objectionable material and shall be screened when necessary over a one-half inch screen to eliminate dust and small particles.

Expansion Joints. An expansion joint one inch in width shall be left next to the curb on each side of the street or alley, also an expansion joint one-half inch in width will be left every twenty-five feet across said pavement at right angles to the curbs. Said expansion joints are to be filled with an asphalt paving filler of proper quality and consistency approved by the engineer. It will be applied while heated to a temperature of about four hundred degrees Fahrenheit, and shall be so applied that said expansion joints shall be thoroughly filled clear to the top of surface of said pavement.

All forms for expansion and contraction joints shall be made of iron or steel in the form of a template, cut to the desired shape of the street according to the plans, and of sufficient strength to resist springing out of shape. All mortar and dirt shall be removed from forms that have been previously used. The forms shall be well staked to the established lines and grades.

Contraction Joints. Contraction joints shall be made entirely through the pavement every twelve and one-half feet at right angles with the street.

The edges of all expansion and contraction joints shall be rounded to a radius of about one-half inch with proper tools.

Care shall be taken to obtain a surface free from ridges, at expansion or contraction joints, and depressions or unevenness in the surface, that will detract from its appearance, or cause water to lay on the pavement.

Any section having such inferior surface will be rejected, and shall be rebuilt by contractor at his own expense.

Care shall be taken to make the expansion joints in such a manner that they are practically the same width throughout their depth.

Extreme care must be exercised in removing templates or divisions used to make expansion or contraction joints; the breaking out of any portion of the pavement in removing such templates and forms will not be tolerated, and such damaged portions of the work shall be torn out and replaced in good condition by the contractor at his expense.

The contractor shall keep pavement sprinkled for one week after it is laid or longer if deemed necessary by the engineer.

The contractor shall keep the streets barricaded where pavement has been laid at least two weeks after the completion of the same.

The above specification was followed very closely in every detail.

In this work twelve thousand barrels of Northwestern States Portland cement were used; from every car ten samples were taken, tests were made for fineness, tensile strength and specific gravity, also boiling tests were made.

In the construction of this work a mechanical batch mixer with a twenty-five foot boom, with a traveler on the same, was used. This mixer is manufactured by the Koehring Company of Milwaukee.

After the sub-grade had been thoroughly rolled the material was distributed along the street, the rock on one side and the sand on the other. The mechanical mixer was set up at the end of the street twenty-five feet from the place of beginning. In the first section, twelve and one-half feet by thirty feet, the concrete was placed. Immediately the wearing surface was placed upon the concrete, not to exceed twenty minutes elapsing between the time the concrete was placed and the wearing surface was put on the same. Then following the next section of twelve and one-half feet by thirty feet was put in. Then the mixer propelled itself backward twenty-five feet and proceeded as before.

Parallel with the curb and ten feet out from the same the wearing surface was cut through into the concrete, these parallel cuts being ten feet apart so that our actual blocks of concrete are only twelve and one-half feet by ten feet.

Some of the streets where the cement paving was laid were very soft and swampy. To obtain a dry and well drained sub-grade a trench parallel with the curb on each side of the street and eighteen inches out from the curb and eighteen inches below sub-grade was excavated and a four-inch drain tile laid in the same and said drain tile connected with the sewers. The earth excavated from said trenches was hauled away and said trenches were re-filled with good, clean, hard, burned cinders, making a thorough drainage for the sub-grade.

The contract price for these cement pavements, including excavation, was $1.25 per square yard.

The cost to property owner was five cents a square yard in addition to the contract price, which includes the cost of engineering, inspection, advertising and levying the assessment, making a total cost of $1.30 per square yard to the lot owners abutting on said paving.

The Garbage Crematory at Houston, Texas*

By David M. Duller, C. E., Houston, Texas

Of all the methods of destroying garbage and refuse, that by fire is by far the most effective, as thus all accompanying bacteria are killed and the organic matter is completely oxidized into gases and only ashes are left behind. The destruction of garbage, or, what is more correct, its reduction to ashes, in crematories especially built for this purpose, is therefore now in almost universal use.

The design of a furnace for the burning of garbage, street sweepings, rubbish, etc., is, however, by far more difficult than it appears to one unacquainted with the problem. This is due to the ever-changing composition of the materials to be destroyed and to the difficulty of securing complete combustion. Garbage, street sweepings, etc., contain a great amount of moisture, often from 30 to 72 per cent., which must be evaporated either in the process of burning or by preliminary drying, and a very high temperature and an excess of air must be maintained in the furnace at all times, as otherwise the chimney gases will be extremely offensive.

There have been put into service a number of different furnaces or garbage crematories, but most of them have only been successful in larger cities, where the different kinds of refuse are collected separately and where continuous operation can be maintained. Most of these large crematories need auxiliary fuel, and with some of them a special apparatus for preliminary drying of the refuse had to be connected. Both cost of construction and cost of operation have been very high, and even for larger cities of 100,000 inhabitants and over, a garbage crematory plant up to this time has been a heavy burden. There was no furnace which met the demands of smaller cities, and, although the necessity of a crematory has been felt everywhere, even in the smallest country towns, the city authorities were unable to install such a plant on account of its excessive cost.

Even a great number of larger cities have, after careful investigation, decided not to utilize the crematory heat for steam production on account of the following reasons:

1. If the refuse is not collected separately, its fuel value is very low, and, as these plants have to use a large percentage of auxiliary fuel with the garbage, the cost of steam production is often greater than if good fuel were burned alone.

2. The boilers must be about twice as large per horsepower generated as would be required in an ordinary plant. If fuel is reasonably cheap in the locality where the plant is to be built, the economy effected by using the waste heat from the crematory will not pay interest on the increased investment.

3. The temperature and the volume of gases from the crematory vary so much that the generation of steam is very unsteady. It is, therefore, always necessary to employ an additional boiler, fired separately, to generate enough steam to make the power steady. This again increases the cost on construction and operation, and, therefore, even at its best, the utilization of the waste heat is a doubtful economy.

4. There is, as a rule, a great increase in cost of the hauling of the refuse to the power plant. In order to use the steam to the best advantage, the location of the plant can not be decided upon from the standpoint of economical transportation alone, and very often the increased cost of hauling dissipates all the savings which possibly could be effected by steam generation.

There are, however, conditions in certain localities where, on account of some manufacturing concerns, large public institutions, homes, trades, or the like, a great amount of combustible refuse is produced, and where in connection therewith, for the reason of high prices of fuel in such locality, the generation of steam by burning this refuse will be economical. These, however, are very rare instances, and even then very careful investigation by experts should be made before any decision is reached to install such steam plants.

The Thompson crematory for the city of Houston is not designated to utilize the waste heat for steam generation. The crematory is, however, designed so that a water-tube-grate, in which sufficient steam can be produced for driving a blower to increase the

* A paper before a convention of Health Officers of Texas.

draft, if such should become necessary for certain purposes, may be installed. In all ordinary cases, however, where mixed refuse is burned, natural draft alone is used, no blower or other machinery is attached, and therefore the Thompson crematory is a model of simplicity and economy, and is by far the most economical furnace ever designed for this purpose.

A careful study of the subject and investigation of the local conditions and the results of garbage disposal plants in a great number of other cities, and a series of very exhaustive experiments, resulted in the design and installation of a crematory plant for the city of Houston which has now been in successful operation for over three years.

There has hardly ever been any other crematory plant used as hard and for so many different purposes as this one, but it stood all the tests to the fullest satisfaction, and the results of the most severe tests have been excellent in every instance.

In one test there were twenty-three dead dogs cremated in one day without the slightest trouble, no auxiliary fuel, except the regular trash and garbage was used, and no offensive odors of any kind were noticeable.

This crematory is located in the center of a well-built section of the city, and has done its work without any objectionable effect. For over three years this crematory was the only method that the city of Houston used for destroying its garbage, refuse, the smaller dead animals, etc.

In the Mayor's annual message and department report the following statement is made:

"The operation of the garbage crematory has been satisfactory. This plant has a capacity of sixty-five cubic yards, and is sufficiently large to care for all the garbage removed from the business center of the city. Not only is it a benefit from a sanitary standpoint, but by reason of the fact that the haul is shortened, it is possible to clean the business center of the city earlier, with less equipment, than would otherwise be required. No fuel is necessary for the furnace, as the lighter material is made to serve as fuel to consume the heavier substances. The smaller animals dying in the city limits are cremated here, and last summer the 563 dogs destroyed by the dog catcher were disposed of in this manner."

As a consequence of the excellent results obtained, the city of Houston has now replaced this plant by a new Thompson crematory of a larger capacity.

In reply to our inquiry we received a letter from the city engineer of Austin, Texas, commenting on the satisfactory working of their Thompson crematory, which had been in use for several months.

The construction of the Thompson crematory is very simple, and therefore the cost of its maintenance and operation is reduced to a minimum.

The furnace consists in the main of a vertical cylindrical combustion chamber, which by a series of grates is horizontally divided into four different compartments. The lower compartment is the ash-pit, which is provided with a clean-out door through which the ashes are removed and by which also air can be admitted. For this purpose special air regulators are also provided.

The second compartment is the room between the secondary and main grate. Here the cinders and ashes which have passed the fires above and have dropped through the main grate are reburned before they finally pass into the ash-pit, and therefore absolute combustion must take place. This chamber is also provided with all the necessary regulators.

The third compartment is the room above the main grate, and, as the name implies, the hottest fire is maintained here on this grate. Stoke holes, air inlets and clean-outs are also provided here.

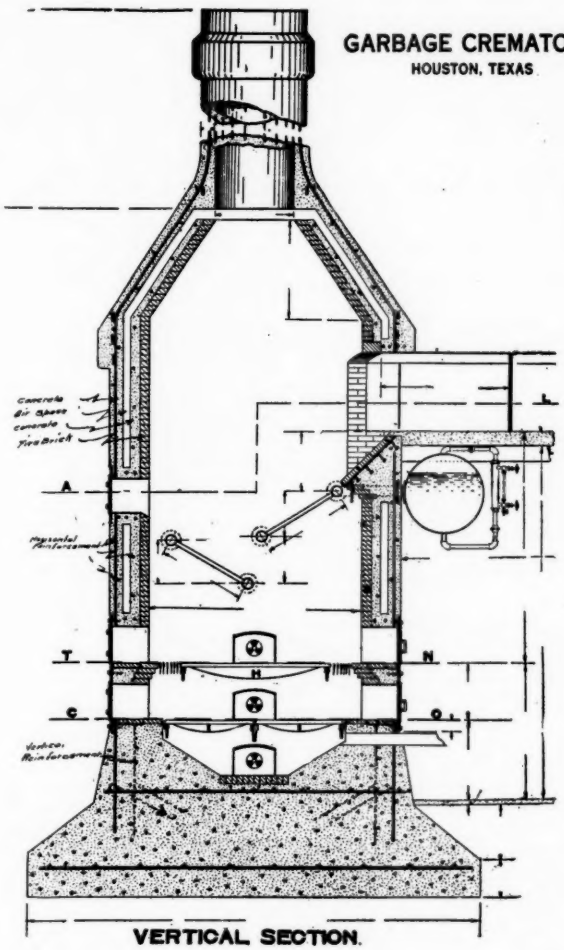
The fourth compartment is the room above the water-tube grate, and this compartment is connected with the chimney, which is built directly over it, thus securing the best possible draft conditions.

The furnace is charged through the feeding chute, which empties above the water tube grate. This grate is so arranged that it holds the garbage like a basket, and allows it to drop on the main grate only after a preliminary drying has taken place and after the more bulky materials have been partly reduced. In this manner any clogging of the main fire is most effectively prevented, and odorless combustion is possible at all times.

The water tube grate is connected with a water tank, which is located under the charging floor, and a free circulation of the water through the tube grates is accomplished. All the steam generated in the tubes accumulates in this tank, and if necessary sufficient steam can be drawn from it to drive a fan or blower. If no use is made of the steam it will either es-

cape through a steam pipe connected with the chimney, or it can be condensed by a small condenser and the water can thus be saved. The water grates are so constructed that they can easily be cleaned in all parts, all main connections of same being located at the outside of the furnace.

The Thompson crematories are built of two strongly reinforced concrete walls, with an air space between, and heavily lined with fire brick. The chimney is of reinforced concrete, built according to the Weber system, which today, without any doubt, represents the most advanced type of chimney construction and has proved its superiority by long years of hard use in almost all civilized countries. The figure herewith shows the details of construction, the location of the reinforcement and the arrangement of air isolation chambers, which are provided to protect the outer concrete walls against excessive heat from the furnace within. All manholes, stokeholes, air regulators, charging chute, grates, dampers, water tanks, etc., are made of cast or wrought iron, as best adapted for their purpose, and only first-class materials are used in every instance, together with best possible workmanship.



VERTICAL SECTION.

The operation of the crematory is very simple. After a small fire has been started on the main grate with easily combustible materials, selected from the refuse, the plant is charged through the chute. Care must be taken to have the water tank filled before starting the fire, in order to prevent burning of the tube grates.

On the water tubes the garbage, etc., is suspended until it is dried and sufficiently charred to fall through them directly upon and into the main fire, where it is fully consumed. The cinders falling through the main grate are retained on the secondary grate below, and only after they are completely incinerated they can pass into the ash-pit.

Tin cans, bottles, wire, iron, flower pots and similar materials are taken from the garbage by the man on the charging floor and thrown directly into the ash pile.

There are only three men necessary for operating a twenty to thirty-ton crematory. One of these men, who acts as a foreman, should have some intelligence and must understand the operation of the plant in every detail. The two others can be common laborers, as their work consists only of feeding the furnace, removing the ashes, stoking, etc. There is no other expense connected with the operation of this furnace, and therefore the Thompson crematory is the most economical in operation.

The Thompson crematory has the following advantages over any other type of furnace known for the reduction of solid wastes:

1. The cost of construction is very low; in fact, it costs less than one-tenth of some plants built heretofore by several other crematory builders. For this reason even the smallest town can afford to own such a plant and to secure for its citizens all the benefits derived from its operation.

2. The Thompson crematory requires no auxiliary fuel for its operation. On account of its ingenious construction and the arrangement of the grates, one directly above the other, drying and burning of the trash takes place in the same furnace.

3. On account of the excellent natural draft obtained by placing the chimney directly over the furnace, without any horizontal flues, absolutely perfect combustion takes place, and a high temperature is maintained in the furnace at all times.

4. There are no objectionable odors of any kind connected with the operation of the plant. The Thompson crematory can be located within any part of the city. By this arrangement the cost of collecting and hauling of the refuse is greatly reduced, and this reduction alone more than pays the cost for the operation in most instances.

5. No continuous operation is necessary to obtain best results. The crematory can be used for several hours per week only if so desired. This is of highest importance for smaller towns, where only one collection per week is all that is required. This is also an important point in large cities, where, in order to reduce the cost of collecting and hauling, a small furnace is built for each district. When there is not enough garbage in each district to keep a crematory in continuous operation, the same men can be used to operate the different furnaces alternately.

6. On account of its compact construction and the arrangement of building the furnace and chimney on the same foundation, a minimum of space is occupied by the Thompson crematory. The whole plant can be erected on a small lot, and, in fact, no other garbage crematory can be compared with this type in that respect.

This crematory is designed in different sizes, in accordance with the requirements, from the smallest type for large private residences, hospitals, hotels and other institutions, to the largest sizes for large municipalities, military camps, etc.

The smaller types can easily be built within a basement, and if they can be connected to an existing chimney of sufficient size, the cost will be greatly reduced.

The larger sizes are capable of consuming from twenty to one hundred tons and more of garbage per ten-hour shift, in accordance to the grate areas and composition of the waste to be burned.

The cost of construction depends largely upon local conditions, prices of building materials, subsoil for foundation, etc.

Sewerage at Orlando, Fla.

By S. H. McMullen, C. E., Anderson, Ind.

ORLANDO is a city of 5,000 population in the east central part of Florida. It is a modern, up-to-date city. Its principal street is paved with brick and most of the others are made of a marble clay found near the city. This clay packs hard, making beautiful driveways for the streets and surrounding country.

The sewerage system is very peculiar. Inside the city limits there are thirteen lakes. The largest is about half a mile across. All these lakes drained into what was known as the Sink. All the surface drainage of the city passes to the nearest lake and from there to the Sink. A few years ago this Sink, from some unknown cause, suddenly closed and the water around the Sink began rising till it covered some two hundred acres of surrounding territory. The citizens were at a loss what to do, but finally summoned an expert engineer, who, after examining the territory drained, decided there must be an underground river or cavern of some sort. So an eight-inch pipe was driven near the Sink, and at a depth of 400 feet there seemed to be an empty space. Water arose within a few feet of the top. As Orlando is 135 feet above sea level, this space is 265 feet below sea level. The pipe was cut off four feet below the level of the surface water and as soon as the obstructions were removed the back water poured in with a roar. An eight-gallon tin bucket turned upside down over the pipe had the bottom torn out as though it was paper. After draining this surface water all off, the fire engines were brought and six lines of hose with 2½-inch nozzles put into the pipe, and with all running in at once, they could not fill it up.

The principal business blocks of the city and many residences are connected with the sewer system for house drainage. The smaller business houses and most of the residences have out-houses with galvanized buckets. These buckets are emptied and washed each week. The city is clean and their system of sewerage seems well adapted to the place.

Modern Sewage Disposal

By F. W. Kerns, C. E., San Francisco, Cal.

THE question of the best method of sewage disposal for inland cities is so largely a matter of local conditions that the last word cannot be said without a thorough investigation of each particular case. Besides the local physical conditions and characteristics, there must also be considered the sanitary laws and regulations, which, in the United States, are not yet as well crystallized as in England or on the continent, where the greater density of population earlier forced the consideration of such matters.

The principal methods that have been or may be used to advantage in interior cities are:—disinfection, electrolysis, irrigation, screening, filtration, septic or sedimentation tanks, and various combinations of these.

The disinfection method of disposal, in certain cases, may be useful, but at present, it is expensive, and somewhat in the nature of an experiment. Proper disinfection requires previous treatment to remove solids of any considerable size, as disinfectants do not penetrate solids to a sufficient depth to destroy disease germs.

Another method yet in the experimental stage and needing verification under other and varying conditions before its worth is fully proved, is the electrolytic process, for which great success is claimed at Santa Monica, California. The claim is made that practically all bacteria are destroyed and that the effluent is a colorless, odorless liquid containing only an inoffensive flocculent matter or coagulum. This plant, however, is essentially a combination of methods, the preliminary treatment only being electrolytic,

the final treatment being dilution in the waters of the Pacific.

The method proposed as ideal, ever since the inception of the sewage disposal question, is the irrigation method, which, under ideal conditions, should return all waste matter to the soil as fertilizer. But like most ideals, this has never been realized. Only in arid localities, where the water is of more value than the fertilizing matter, does there seem to have been even partial success. The extreme dilution of sewage renders the plant-food elements practically negligible and a large part of the soluble elements drain through the soil. Cold, the constant flow of sewage, the absence of crops in certain seasons and the lack of certain soil elements or of aeration and oxidation unless the process is intermittent, all combine to prevent the formation of plant-food elements in an assimilable form. An inherent prejudice, not without reason, against the products of sewage farms, and the necessity for nitrifying plants, confines the crops that may be raised to a few varieties. Where preliminary treatment, resulting in the production of sludge, is used, certain elements are retained in the sludge which may have a small value as a fertilizer, but it is not as efficient as an artificial fertilizer. While a profit is shown for the sewage farm at Pasadena, California, and also at Melbourne, Australia, the profit seems to be due to the increase in the value of the land in the former place, and to the omission of the proper capitalization charges in the latter.

Screening devices of nearly every form imaginable have been built and tried, particularly in Germany, but even here they are being replaced by sedimentation tanks, which are found to give better results for the removal of suspended matter. The field of usefulness for screens seems to be limited to the removal of only the coarser material that might interfere with pumping or other subsequent treatment.

Land filtration is undoubtedly one of the best and most economical methods to be employed, where land of sufficient area with suitable character and location is available, a combination which is rarely to be had. The experiments of the Massachusetts State Board of Health have furnished results that enable the adaptability of land for filtration to be determined, and if this be favorable, the principal points requiring attention are a proper distribution and drainage system. Where a tract of suitable character or size cannot be obtained, an artificial filter may be constructed, which may be either of the percolating or contact type. In the former type, the sewage percolates or trickles through the filter continuously, and on account of the better aeration, it gives more satisfactory results and is superseding the contact type, which is filled and emptied intermittently. To prevent clogging of filter beds, preliminary treatment, such as screening, sedimentation or septic tanks is usually necessary.

The advent of the septic tank was heralded some years ago as the panacea for all sewage disposal ills. Popular articles described the complete destruction of all matter (both organic and inorganic) by bacteria, that in their greed finally destroyed each other, the sole survivor dying of starvation, in a tank from which light and air were absolutely excluded, lest nature be disturbed in her secret and wonderful process, and from which an effluent as pure and sparkling as drinking water issued.

Cameron's patent claim, made in 1896, was that "the sludge portion of crude sewage is entirely thrown into solution," and that the gases produced would be a source of revenue. Investigation soon demonstrated that septic action did not liquefy and gasify all matter and that the sludge question must be seriously considered. Claims for the percentage of sludge digestion in the tank dropped from 100 to 50 per cent, then to 33 per cent, and recent reports place it as low as 10 per cent, while some authorities question any digestion at all, attributing apparent digestion to deposition and concentration. It was found that nature did not require a "dark room," but that action took place as well in an open as in a closed tank; and that the escape of hydrogen sulphide, having the odor of spoiled eggs, rendered the treatment far from inodorous, as had been claimed. The following is an extract from a report, recently made for the Chief Engineer of the New York Board of Estimate, on the septic and filtration plant at Columbus, Ohio, one of the most modern in the United States: "The fact that a strong wind was blowing almost continuously was advantageous. * * I caught the odor from the purification works suddenly and strong at a distance of about three-fourths of a mile from the works. There was no doubt about the character and offensiveness of this odor. It was characteristic of the septic tank and, for the moment, was nauseating. For the distance of three-eighths of a

mile, this odor was dully sickening; from this point, it decreased in intensity and intolerability until a point to the windward of the septic tanks and in the vicinity of the filter beds was reached, where it was not so intensively offensive. * * The universal testimony (of various persons) was to the effect that under certain conditions, intolerable odors were appreciable to the limit of from three-fourths of a mile to one and one-half miles from the works, and the plant might be honestly considered a nuisance up to these limts."

Continued experiment showed that the septic tank gave an effluent that was not only offensive to smell, but that was putrescible; the fact was overlooked that a clear liquid could contain material that would putrefy; that is, organics, capable of putrefaction, could be dissolved in the clear effluent the same as ordinary sugar or salt is dissolved. It thus became evident that the septic tank was but one-half of the purification process, and that subsequent treatment was necessary.

And finally, experiments made by the Massachusetts State Board of Health ten years ago, and others, showed that the filter bed results were often better from raw than from septic sewage; and that if allowed to go too far, the septic action introduced poisons into the effluent that injured, rather than aided, the filter-bed results.

Though the septic tank has been clung to most tenaciously in England, its home, it is slowly but surely losing ground even there. Experiments convinced Mr. Mawbey, Engineer, of Leicester, England, "that advanced septic action certainly retarded, rather than faciliated the purification both in the beds and upon the land" and that the best treatment is sedimentation short enough to avoid septic action. Mr. Mr. John D. Watson, in charge of the tank at Birmingham, England, states that if he were starting anew, he would avoid septic action.

Rudloph Hering sums up the situation regarding the septic tank in Europe in the quotation: "The septic tank has gone; we have no further use for it." Dr. Dunbar, of Hamburg, Germany, in his work written in 1907, summarizes on the septic tank as follows: Advantages: (1) the separation of the solids; (2) the uniform mixture to be obtained from sewage very variable in composition; (3) the preparation of the sewage for biological after-treatment; (4) the utilization of the gases from the septic tank; (5) the diminution of the amount of sludge; (6) the septic sludge is more easily drained; and (7) the injurious action on pathogenic organisms. Disadvantages: (1) The foul smell of the effluent; (2) the increased difficulty of biological after-treatment; (3) the corrosive action of the septicized sewage on cement; and (4) the injury caused to fish life, due to the large quantity of sulphuretted hydrogen present in the effluent from septic tanks. Of the advantages, (5) is of small utility and (4) of none; (7) is of little value, as the principal danger from pathogenic germs is in drinking water, which can be purified enormously cheaper than can sewage; while (3) is accomplished better, and (1) and (2) as well, by the smaller and cheaper sedimentation tank. Of the disadvantages, none can be urged against the sedimentation tank.

Plain sedimentation tanks, which are simply settling chambers built only large enough to retain the sewage one or two hours, and from which the sludge is removed at intervals frequent enough to avoid septic action, are gaining ground as surely as septic tanks are losing. In Germany, the tendency is toward only a preliminary screening or sedimentation of sewage that can be discharged into streams under water. That movement in America is along the same lines, is indicated by the recent series of reports and subsequent discussion concerning the discharge of the sewage of the city of Rochester into Lake Ontario, 50 feet under water and 7,000 feet from the shore, the preliminary treatment being screening and sedimentation only. The outcome of the discussion and reports by some of the most prominent sanitary engineers of the United States was the recommendation that the original plans be changed so as to provide for future extension and multiple instead of single discharge, doubling the size of the sedimentation tanks, and the addition of scum boards for the retention of grease. At times, when the full capacity of the system is reached, the time of retention in the tanks, after being doubled in size, will be but ten minutes, so that they are in reality little more than grit chambers. The summary by the Chief Engineer of the State Health Department was that the preliminary treatment by screening and settling, followed by dilution, oxidation and digestion in the Lake, would remove the larger and most of the suspended matters, that no traces of matter offensive to the senses would appear along the lake

shore, and that there would be little danger of pollution reaching the water supply intake, three miles distant. For Toronto, practically this scheme of disposal is being followed, the point of discharge in the lake being 4¾ miles from the water supply intake.

A combination of septic and sedimentation tanks, retaining the good and eliminating the bad features of both, has been recently developed by Dr. Karl Imhoff in Germany. In this tank, the liquid portion of the sewage is allowed to remain only long enough to deposit practically all matter removable by sedimentation, passing on through the tank before becoming septic. The solid matter sinks to the bottom of the tank, where it remains long enough to undergo complete septic action, being separated from the upper portion of the tank by an overlap. This overlap prevents the passage of gases, carrying small particles of sludge, through the upper portion, so that there is no escape of sludge with the effluent. It is claimed that there is little, if any, hydrogen sulphide generated (the principal products being inoffensive carbon monoxide and methane) and that the complete bacterial action transforms the sludge into inodorous humus, resembling loam, that drains and dries rapidly, the drainage water being clear and inoffensive. A few of these tanks have been installed in America, that are said to be fulfilling the expectations aroused by foreign results, and Atlanta, Georgia, is now preparing to treat all sewage in Imhoff tanks.

A comparatively recent development in sludge handling machinery, is the Schaefer-ter Meer centrifugal machine, that is in operation in Germany and in one or two places in the United States. This machine dries from 70 to 140 cubic feet of sludge per hour, effecting a reduction in volume to 14 to 20 per cent of the original. No manual labor is required except in removing the dried sludge, which is automatically ejected from the machine, but the cost of the machine is too high to be borne except by cities having a large amount of sludge to treat.

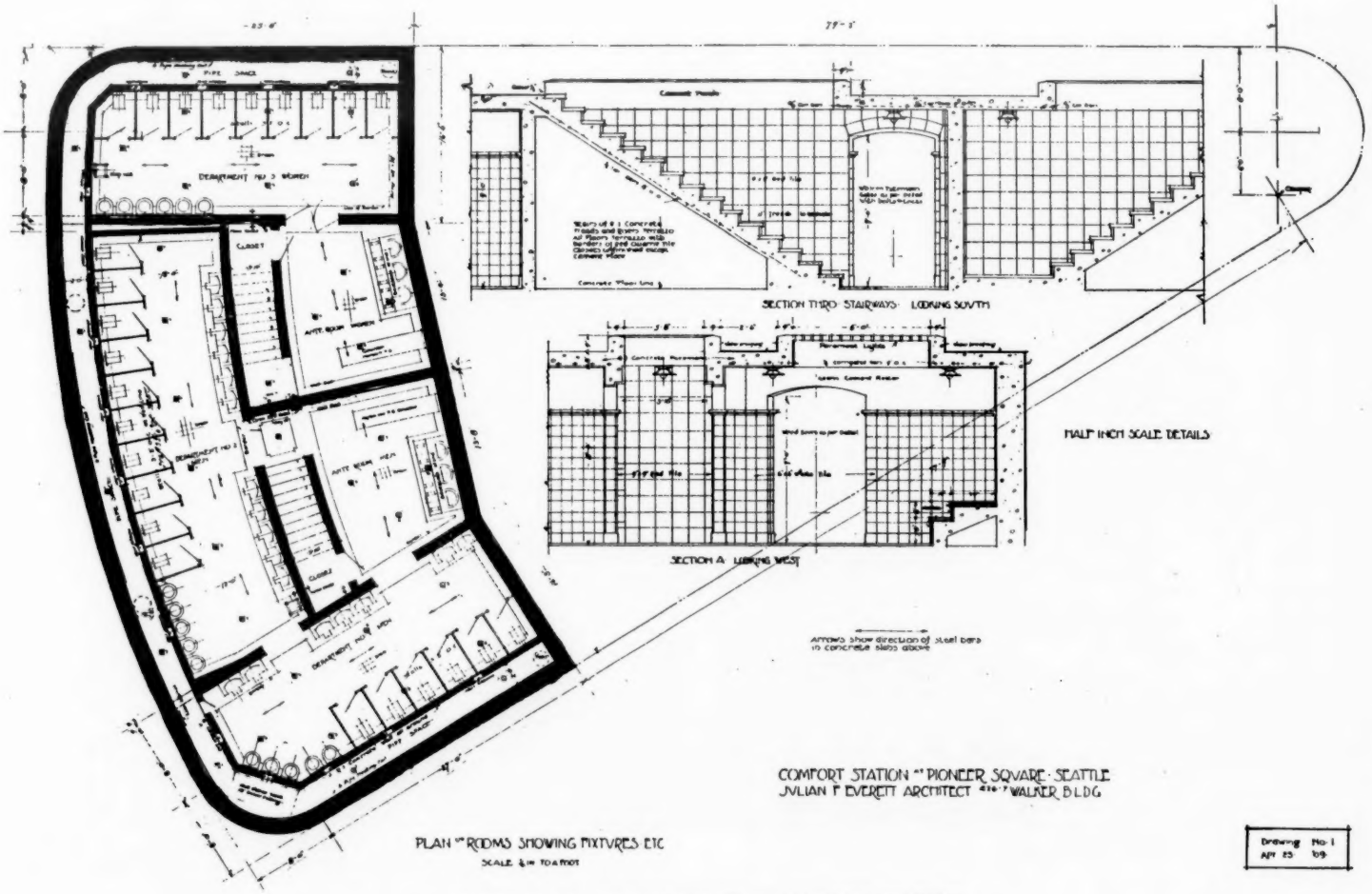
Public Comfort Station at Seattle, Wash.

WITH advanced ideas characteristic of the great Northwest, Seattle has constructed a public comfort station in which is embodied all that is best in sanitary construction. This station, which was completed about a year ago, is described in the *Pacific Builder and Engineer*. A short abstract of this description is given herewith.

When the movement to obtain the station was instituted some of the local papers mistakenly opposed the matter, and a slight opposition was made to its construction. Ferdinand Schmitz, the president of the park board, under whose direction the matter was placed, offered to build the station; and in event that it should not prove satisfactory, to have it removed at his own expense. No further opposition was encountered and the work was allowed to proceed to completion.

The station was constructed, as is shown in the accompanying diagram, so as to occupy the base of the triangular plot, known as Pioneer Place; and upon the apex of which is located the Totem Pole, so well known in connection with Seattle. The location, First avenue and Yesler way, is at the intersection of two of the city's main thoroughfares. Three of the four nearest street corners are occupied by banks, and the fourth by the city ticket office of one of the transcontinental railroads. Two of the crosstown and the Tacoma interurban car lines terminate within a block of it; it is also passed by a large majority of the Puget Sound and coastwise steamship passengers.

In the design of the station the first consideration was given to sanitation and ventilation; but that the ideas of beauty were not neglected is evidenced by the accompanying photograph of the canopy which forms the above ground portion. The entrances to the women's and men's sections of the station are at opposite ends of the canopy and are protected by heavy grill railings. The approaches are over concrete, and the stairs are of concrete. The stairway walls are of red tile. The floor of the entire station is laid with a heavy foundation of solid concrete, draining to the center of each room. The walls are laid up to a height of six feet with white tiling, six inches square. All stalls are di-


SECTION THIRD STAIRWAYS LOOKING SOUTH
SECTION A LOOKING WEST
HALF INCH SCALE DETAILS
COMFORT STATION AT PIONEER SQUARE SEATTLE
JULIAN F EVERETT ARCHITECT 410-7 WALKER BLDG
PLAN OF ROOMS SHOWING FIXTURES ETC
SCALE 1/8 IN TO A FOOT
Drawing No 1
Apr 25 09

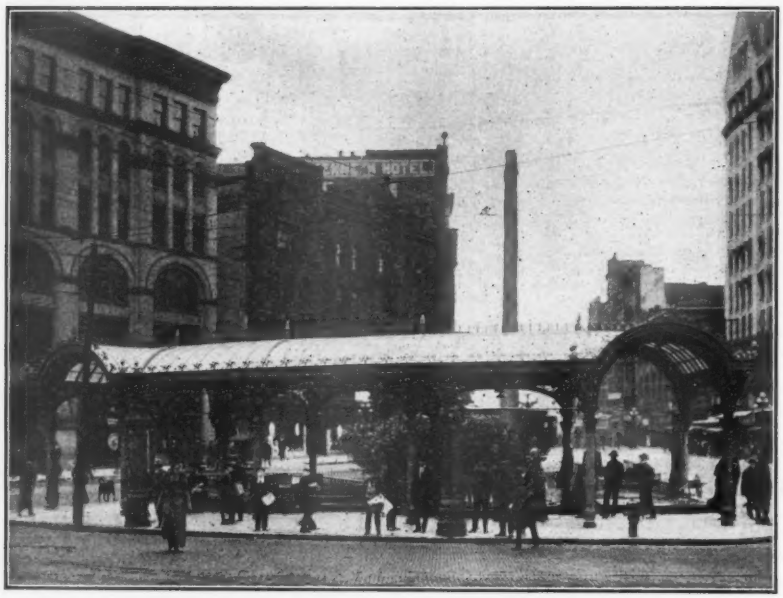
I. FLOOR PLAN. SEATTLE PUBLIC COMFORT STATION.

vided by large slabs of gray-streaked white Alaskan marble mounted on nickel-plated brass sanitary legs; the same quality of marble is used in the finish of the shine stands. The walls above the tiling and the ceilings are finished with Keene's cement in an ivory tint.

The problems of heat and ventilation have been handled in a unique manner with highly satisfactory results. The apparent absence of any special features connected with either system is certainly the strongest detail of the design. This has been accomplished by a 2-foot air space running around three sides of the station. First a 12-inch area wall of plain, solid concrete was constructed, and inside of this a false wall 6 inches thick and of reinforced concrete. On each of the three sides of the area wall is mounted a 6-coil pipe supplied with steam from the central heating station of the Seattle Electric Company. The air space is connected with the main room by bronze gratings located about 8 inches above the floor level and at 6-foot intervals. The desired temperatures throughout the station are thus secured by indirect radiation. Each of the ante-rooms is secured against too low a temperature by 9 feet of direct radiation.

Every toilet is ventilated from beneath the seat by a pipe which leads to the foot of the vent posts, of which there are four. Individual motor-driven fans with a capacity of 12,000 cubic feet per minute are installed at the foot of each vent post, and there pick up the foul air, discharging it at an elevation of 11 feet above the pavement.

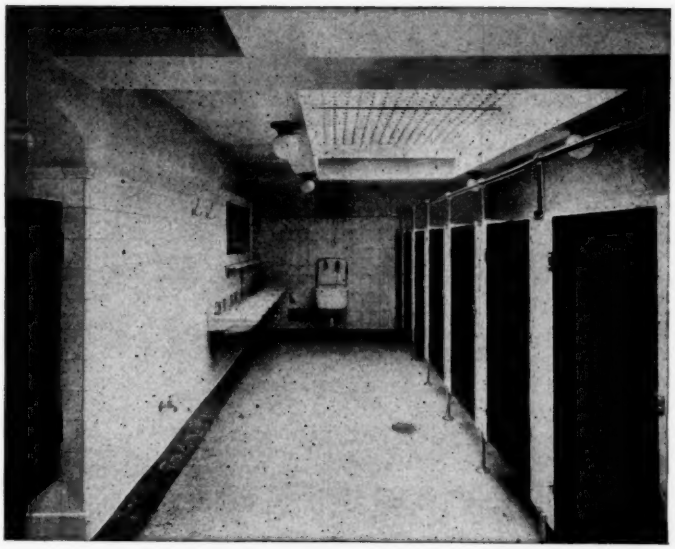
The air space is further utilized for the installation of all flush tanks to the toilets; for a suspended cylindrical 300-gallon galvanized iron hot water storage tank; for the cooling coil and steam traps; for the indirect connections of the two catch basins which receive the roof water and discharge it into the sewer; and for the connections with the combined trap and back water valve that is installed on each floor drain.



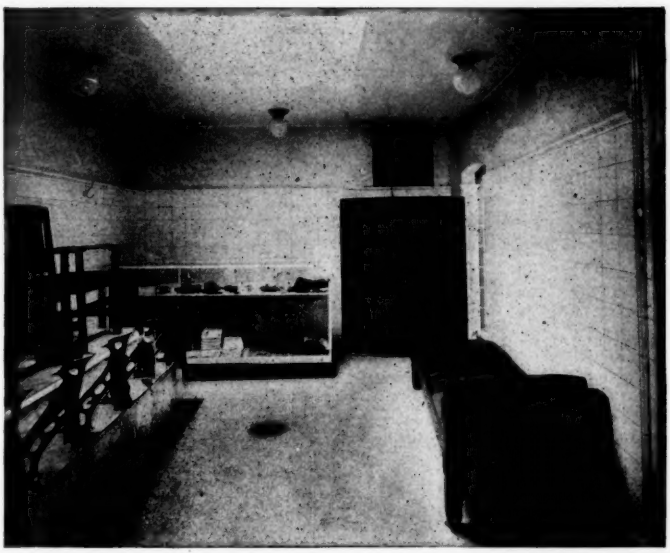
II. IRON AND GLASS CANOPY AND ENTRANCES.

Plenty of sunlight is always a requisite of cleanliness and perfect sanitation, and in a surface station it can easily be secured by adequate window space, which is out of the question with an underground installation. One would hardly believe it, yet the generous use of prismatic sidewalk lights with the white tile, marble, and ivory ceilings makes the interior of the station seem brighter than the outside. At night the rooms are abundantly lighted by electricity through ceiling globes.

The fixtures throughout are of the



III. MAIN ROOM WOMAN'S SECTION.



IV. ANTE ROOM WOMAN'S SECTION.

most approved sanitary types, being constructed of porcelain, vitreous china and nickel-plated brass. This principle of cleanliness is carried out even within the ante-rooms of the two sections, where the marble shine stands are furnished with oak and brass arm-chairs. A noteworthy feature of the station is the fact that shine stands are provided in the ante-room of the woman's section, a convenience which is much appreciated.

The station complete cost $24,505.85. It was designed to accommodate an attendance of 10,000 per day of 18 hours, from 6 a. m. to 12 o'clock midnight. The average attendance has been found to be about 5,000. The care of the station is given over to a man and his wife, who have the assistance of three others, all under the supervision of the superintendent of parks.

The extreme cleanliness and apparent sanitary condition of the station are attested by the photographs here reproduced. The fact that these photographs were made entirely by time exposures testifies to the excellent light within the station, despite the fact that it is entirely beneath the surface of the ground.

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

Construction of Plant and Selection of Electrical Equipment

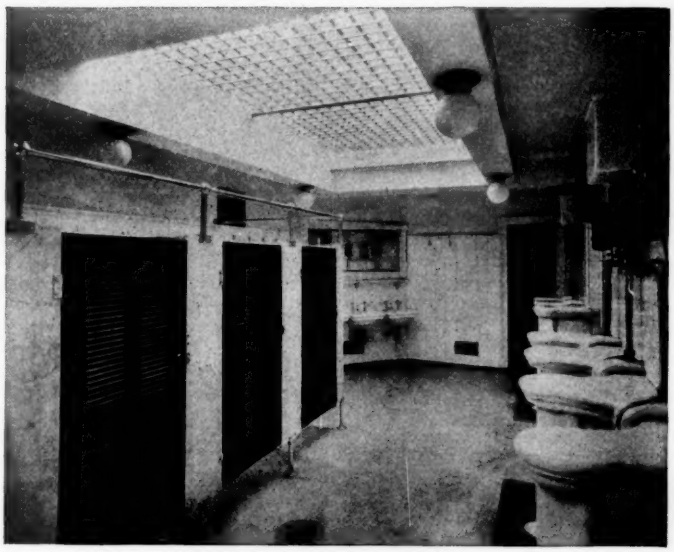
IN the last article the readers were taken through the program of preparing for and selecting and designing the recommendable development plant. The present article will complete the presentation of this topic by considering the construction of the works and the selection of the suitable generating and transmission equipments.

The preparation of detail plans, specifications and estimates is necessary before construction negotiations can be approached. Each part of the works, spillway, dam, diversion conduit and power station requires separate treatment. The plans consist of spillway, dam and dam location, general elevation and typical sections; foundation, with details for cut-off, anchorage and apron; sub and superstructures and details of dimensions, shapes and joints; abutments in plan, elevation and sections with details of cut-off connection and drainage: silt and waste sluices, log chutes, fish ladders, flashboard supports; gates in elevation, section and details; canal or conduit location plans and sectional profiles; canal sections with structural details of lining, culverts and spillways; pipe line benches, trestles, anchorage, mud and air valves and stand pipe; intake and forebay plans, typical sections, construction details; headgate plans and details; power house plan, elevation, sections; foundation, sub and superstructure, wall and floor sections and structural details; door and window plans and details; roof plan and details; tail race details. It is good practice to make plans of uniform dimensions and details of like scales and each plan of details should contain a bill of material required. All dimensions should appear on plans and sections and weights in material bill.

Specifications should clearly describe the intended constructions and specify the methods of operations which may influence the efficiency and cost of the structures. Estimates should be made in detail of operations and materials with ample allowance for delivery and handling.

Operations which cannot be specifically laid down because of unknown conditions or uncertainties are preferably carried on under a cost and per cent. contract. This applies to the control of flow during construction and excavation for foundations below a stated plane. All others may be safely contracted for on lump sum, which carries with it the advantage of fixing the total cost, provided the construction contract is secured by sufficient bonding, safe retained per centage and a binding time clause.

However it is true that it is now more generally the custom to construct such works on cost and per cent., cost and fixed sum, or by the development company themselves. Each case pre-



V. PAY ROOM MEN'S SECTION

VI. FREE ROOM MEN'S SECTION.

sents conditions favoring one or the other of these construction programs as guaranteeing the greatest economy and these should be carefully weighed before the final decision is made. Development companies know that contractors must capitalize their operations, charge interest on investment, depreciation and maintenance of plant, liability and accident insurance for personnel, and a profit from fifteen to twenty-five per cent., and that they must discount uncertainties with safety to themselves. The most rapid completion of the contract may not be of greatest advantage to the contractor, his construction equipment may not make such a result possible and it may not be to his interests to invest in what would be needed. An old adage runs "if you want a thing done well do it yourself" and this applies with a great deal of force to this subject of constructing a hydro-electric plant. The development company has capitalized the undertaking, why should they double up on the interest? Whoever designed and planned the works for them knows more about them than anybody else; construction operations and their execution are planned by men whose services are on the market; construction plant has to be purchased, of course, and after completion represents little salvage, but what of it, the contractor would add its value in his tender. The development company's interests are for most rapid completion to reduce interest during construction period and to put plant in commission and take in revenue and this they can control absolutely. Considering all these points, it is quite possible that the development company may themselves carry on the construction and secure a considerable saving in first cost, most rapid completion and a plant as planned. When plant construction is made a part of the development financing plan, neither efficiency or economy are seriously considered, it is then only a question of successful promoting from the promoter's point of view.

The equipment of a hydro-electric development is wholly apart from its construction, though the designs of the power station must be specifically planned for it. The operating equipment embraces those devices which are needed to control flow, head, floatage, silt, and to handle machinery. They may be gate and flashboard operating machinery, mechanical or electrical, trash-rack clearing tools, pipe-line mud and air-valves, and traveling cranes. Diversion booms may prove serviceable for the intercepting of float timber or ice.

The generating equipment consists of hydraulic turbines and governors, electric dynamos, exciters, regulating and measuring devices. Hydraulic turbines convert water power into mechanical energy and dynamos into electric current. Turbines are of reaction, pressure and impulse type in accordance with the characteristic action of water on them, and this same classification indicates their most efficient application for low, medium or high head developments. A turbine differs from a water wheel in this essential, that it utilizes the potential and kinetic energies of flowing water, while the latter wastes either one or the other of these factors. Water wheels could deliver, under favorable conditions, sixty per cent of the natural energy, while turbines have realized ninety and better. Water wheels are limited to low head developments, turbines may be constructed to utilize water under any head at which it can be conducted to them.

A reaction turbine consists of a movable wheel or "runner" having a hub and shaft with curved vanes or buckets fastened to it, which is placed in a stationary case or tube enclosing it on three sides. The wheel case has rectangular openings on the end or around its shell, filled with movable valve shutters or gates through which the water passes into the interior of the case and the spaces between runner buckets, escaping through the open end. The inflowing water impinges on the convex face of the buckets while entering and passing through, and reacts on the concave face when it escapes from the runner and thus delivers all its energy to the wheel. The opening areas in the wheel case determine the quantity of water which, under the velocity due to the effective head, may pass into the runner and impart to it its inherent energy as rotary motion, and the diameter of the runner determines the speed with which the runner may be revolved. The created rotary motion is transmitted through the wheel shaft as mechanical energy. Energy of flowing water is expended whenever its course is deflected or its velocity impeded. The first may be caused when water enters the gate openings or runner buckets, the second by friction against the entrance, passage and exit-opening walls. These represent theu navoidable losses of the natural energy, to which may be added loss of volume due to leakage between runner and

case and friction in shaft bearings. A properly designed, constructed and installed reaction turbine may return eighty per cent of the available energy. The limitations of the reaction type as regards head are caused by velocity of flow and rotations as exceeding the safe resistance of metal and permissible shaft speeds.

The pressure turbine consists of a runner and case, but the water finds entrance to the wheel through a feed channel of gradually decreasing diameter surrounding the runner, with openings on its interior periphery. The water delivers its energy by pressure against the concave face of the runners upon entering them. The pressure turbine's efficiency may be somewhat higher than that of the reaction. The losses are due to like causes given for the reaction type.

The impulse turbine is a wheel which carries on its periphery cup shape buckets in pairs. The water issues from a nozzle, the jet striking the partition between buckets and delivering to their concave interiors all its energy. Two or more jets may thus be played on one impulse wheel.

In reaction and pressure turbines the water passes from the upper level into the turbine as a continuous water column, which is exposed to the pressure of air only at its origin, and in like manner it may be conducted from the turbine to the lower level at some depth below the turbine through a closed conduit, draft tube, and in that event be free from air pressure from origin at upper to destination at lower level, and in this manner the energy due to the physical difference in upper and lower pool elevations may be utilized in the development of the power. In impulse wheels however, the water passing from the nozzle strikes the air and therefore only the head from upper pool to turbine elevation becomes effective. The turbine equipment is primarily selected to utilize the available fall and flow most efficiently, the former determines the type, the latter the size of turbines. Reaction turbines may be single or coupled in multiples to vertical or horizontal shaft, pressure and impulse turbines single or in units of pairs on horizontal shafts. Draft tubes may have a length of twenty feet. The unit arrangements are based chiefly upon electric output requirements and these latter should be best adapted to service conditions and high resourceful efficiency or great waste may result from faulty generating units.

Turbines are regulated by governors of hydraulic or mechanical type which regulate the water supply or by air governors which regulate the effective head. Hydraulic governors act through a separate fluid pressure relay upon valves, pistons and rods connected to turbine gate riggings; mechanical governors act through friction discs upon turbine gate actuating mechanism; and air governors operate vents in draft tubes, thereby reducing the effective head. The type of governor which meets the requirements most efficiently must be determined from the degree of regulation which is required for the electric service. There is a considerable difference in their first and operating cost. Turbine governors are belt driven from turbine shafts.

The electric dynamos may be of direct or alternating type as regards the characteristics of the generated current; the first is self-contained as an electric generator, the second requires excitation from a direct current machine. A dynamo consists of two principal parts, one stationary, the stator or field, the other movable, the rotor or armature. The first has fixed to it magnets wound with connected insulated conductors, their poles facing the armature, the second contains evils of conductors facing the field poles and interconnected to a final conductor outlet. The magnetized poles are surrounded by zones or fields of electric waves, lines of force, through which the armature coils, when rotating, pass, and absorb from them electric energy in the ratio of number of force lines cut by number of armature coils within a unit of time, the thus collected electric energy being accumulated into two exit conductors. The electric output therefore depends upon number and size of field poles and armature coils and upon speed of rotation. The resultant current (in amperes) acts in the conductors under an inherent pressure (or volts), their product being the useful electric energy or watts. The commercial rating of a generator's output is by thousands or kilowatts.

For reasons hereafter stated the direct current is not well adapted for transmission, and the electric generating equipment consists therefore of alternators and exciters. Generators should be coupled to turbine shafts; exciters may be belt driven from them or by separate turbines. The selection of generator units should be based upon service requirements and as best suiting the available hydro-power

sources, and speed of generators is one of the most essential features to be considered.

The generated current passes to a switchboard, where all its characteristics are indicated and measured and from which it may be regulated. When the output of several generators is to be accumulated on one set of conductors, it is necessary that it be of like characteristics or synchronous from all units, as regards phase frequencies and voltage, and this is secured by aid of the regulating devices on the switchboards.

This finds the generated product product ready for transmission to the distant market point. Electric energy may be transmitted to any distance on a continuous and closed conductor system, but like other transmissions of energy it involves some losses. Those in transmission of electric energy are due to the causes analogous to the piping of fluids, that is friction, and therefore depend upon the size of the conductor, the volume transmitted and the pressure which acts upon the current. In properly proportioned electric transmissions the product may be delivered with a total loss of ten to fifteen per cent, but the pressure or voltage required to secure such a result exceeds the economical generating limit. The voltage of the generated current must therefore be increased before it is put upon the transmission line, which is affected through static or step up transformers. These consist of primary and secondary conductor coils of size and windings in ratio of the desired transformation, all placed in a metal case, and as this process of transforming voltage creates more or less heat, transformers are artificially cooled by chilled fluids or air. Transmission lines consist of supports and conductors, the latter being secured to the supports on arms or brackets and isolated by being fastened to insulators. Supports may be wooden or steel poles or towers, concrete-steel poles are beginning to be utilized. The proper placing and construction of the transmission plant and line is of no less importance to a final resourceful issue than any of the preceding features, in fact a hydro-electric development consists of a number of links which make up a completed chain and this is no stronger than its weakest link.

Labor Saving Devices in Water Works Plants*

By Frank C. Jordan, Secretary Indianapolis Water Company

AT a meeting of the Executive Committee of our Association suggestions were made of various timely topics which might be discussed with profit at this meeting, and one of our committee suggested the advisability of a paper on "Labor Saving Devices in Water Works Plants," and I was requested to prepare a short paper along this line.

It has occurred to me that a paper on that subject would be of considerable value if it were presented in such a way that it would be productive of thorough discussion, for the reason that many valuable points would be brought out by the members of our association when careful consideration was given to a matter of such vital interest to those present.

Letters in reference to the subject were addressed to quite a number of the leading water works superintendents throughout the country, and several very interesting replies were received. These were referred to a committee of practical water works men and from the various letters suggestions were selected which seemed to contain some merit.

In the line of development in the office or administration department of a company, it seems to the writer that Mr. Pollard, of Cincinnati, has stated a well-known truth in very forcible terms, and I desire to quote one paragraph of his letter:

"In my opinion one of the most important factors in keeping down or reducing the cost of operating a water works is the establishment and maintenance of a complete and accurate set of records, both financial and statistical, and the use of recording gauges or other like instruments wherever they can be installed. These rec-

*A paper before the Indiana Sanitary and Water Supply Association.

ords should be kept strictly up to date and should be easily accessible to the superintendent for his information and guidance."

While the truth of this statement is readily admitted by all superintendents, yet it might be inferred from its lack of application that they have in fact not reached a true realization of the value to the department of a complete record of all lines, service connections, etc., as well as a comprehensive record of financial and administrative operation. Reference is made in the replies to the automatic cashier, the addressograph, complete card indexes and loose leaf systems, the adding machine with electric power attachment, outlook envelopes, etc. It would seem that every plant would be equipped with these various labor-saving devices, but apparently such is not the case.

I am indebted to the Louisville water plant for a suggestion which I picked up in their office a couple of years ago which has proven of value. I refer to a notice which answers the purpose of a delinquent notice as well as a water bill, and which can be sent through the mail under one cent postage. The value of this as a labor-saving device and an economical measure is apparent. Meter cards containing the record and operation of the various meters in use, with a record of the cost of repairs, etc., will be found very valuable. A number of forms have been submitted covering the work of the various departments and their value as time-savers is apparent. It is probably not possible to prepare a set of forms which would suit all companies, but with the aid of the adding machines, the typewriters and sensible record forms, the office work in the average department can be materially decreased.

In the distribution department will be found a number of labor-saving devices as well as a number of opportunities for the introduction of new devices which will materially decrease the cost of operation and construction. Mention should be made of the detectorphone by the aid of which it is possible to locate a leak with a reasonable degree of accuracy. Our company has found this instrument of considerable value. The expansion joint used in the setting of large meters or all meters from size 1½-inch and upward is very good. Our Mr. A. B. Helfrich, foreman of construction, has perfected an attachment for the Smith tapping machine whereby it is not necessary to use the ordinary ratchet but the operation of the machine from the surface of the street is made possible. This attachment consists of a windlass, cog wheels and shaft; the cog wheels being connected with a belt chain operating on the cogs. This attachment not only saves considerable time, but also causes a substantial saving in the expense of repairing the pavement, as it is only necessary to cut a hole of sufficient size to admit the tapping machine. A 4-inch power pump to be operated by gas engine or other power for use in case of breaks or in connection with pipe laying, is a very economical appliance. A meter testing device such as the Mueller is not only a time saver but is valuable as a check on the loss on account of slow meters, etc.

Mr. Lyons, of Buffalo, refers to his "waste and leak gang" as being productive of a very large saving in water and states that through the aid of this gang, they have found at least $10,000 worth of water a year which had been used by persons not entitled to it. Similar tests, if carried on with a pitometer, would probably be somewhat more accurate than the tests made by Mr. Lyons, although his method probably would be somewhat less expensive. Reference is made by some of the water works superintendents to the asbestos roll used in pipe laying; the pneumatic hammer for chipping and calking, the steel bar resembling a stone point for taking plugs out of mains; lead wool for calking, to be used where it is not feasible to use lead; the heavy rooter plow for digging the first 24 inches of a ditch; the straight-blade scraper used for backfilling, and the long nozzle made of 2-inch pipe approximately four feet in length used in flushing ditches, by the use of which it is possible to slush the ditch to such a degree that there will be very little subsequent settling. Reference is also made to a pipe derrick so arranged that with its aid four men are able to handle pipe up to 24-inch.

We are impressed with the fact, however, that there is still considerable room for added improvements which will decrease the cost of operation and construction in the distribution departments of the water companies. Among these might be mentioned the following: Maps kept up by the city engineer or other designated authorities on such a scale as to show the exact location of all lines of the various public service corporations such as gas companies, water companies, telephone and telegraph compan-

ies, heating and lighting companies, as well as the public sewers. Such a map would be of great value not only to the city, but to any company desiring to install lines in the congested district of a city. It is unfortunate that the importance of this cannot be realized by the smaller towns and a proper start be made when the matter is a comparatively simple proposition.

There is also room for improvement in the care of the stop and waste cocks in the residences as well as the care of the stop boxes and valve boxes controlling the shut-offs for both the private and public lines. With the growing scarcity of labor in our cities there is a demand for a reliable ditch-digging device built along such lines that it can be economically handled on short lines and in narrow streets. In the pumping deparement the value of a gravity oiling system is apparent and it is a matter worthy of note that with the aid of a well equipped gravity oiling system, the Cincinnati department was able to reduce its oil consumption from a total of 15,000 gallons in 1908 to 4,000 in 1910, with the significant comment that with the oiling system in operation the bearings were always flooded and warm bearings were unknown. The installation of electric or hand-power cranes is also highly recommended. The value of the hydraulic elevator for all large pumping engines is also apparent. Electrically operated valves are of such value as time and labor savers that it is surprising that they are not installed to a greater extent. It will be found that under certain conditions the use of electricity for power in the small plant is a very economical measure, in one plant with which the writer is familiar a booster station pumping approximately three quarters of a million gallons per day, being operated by one man and the only matter of concern is to provide this man with employment whereby he can occupy his time in a profitable manner. Electrically-operated booster pumps are solving the problem of the water supplies of our tall buildings or sky scrapers. A well-equipped machine shop is also an economical measure as well as a valuable time-saver.

In connection with the filtration department, mention is made by the Wilmington, Del., water department of the Blaisdell sand-washing machine, which does away with the necessity of scraping the sand beds by hand, and therefore, eliminates the gang of men usually required for this purpose. The machine which they have in their plant consists of five units mounted on a crane and cleans a swath twenty feet wide. In connection with our filtration plant, we have found that the handling of our sand and other granular materials with ejectors is productive of great saving in labor and time. This method does away with the necessity for a gang of laborers with wheel-barrows.

Many other labor-saving devices have been perfected in connection with the filtration and pumping departments, but they have been reviewed in various engineering papers and it is probably not worth while to again mention them at this time.

It doubtless occurs to us once in a while that the plant in which we are interested is being operated along the most economical lines, but if history properly repeats itself the year 1916 will find us carrying on our work on a much more scientific basis, and that man will serve his community well who perfects devices both large and small which will in their operation tend to the production of a good, reliable supply of water at a minimum cost of production.

A Municipal Pumping Plant Using Producer Gas

By Raymond C. Allen, C. E., Manchester, Mass.

THE equipment of the New Gravel Pond Station of the Manchester, Mass., water works consists of two 65 h. p. gas producers of the suction type. These are manufactured by the Smith Gas Power Co., of Lexington, Ohio. They are provided with mechanical scrubbers for cleansing the gas and are fitted for use with anthracite or bituminous coal. They consist essentially of an upright iron cylinder 10 feet high and 5 feet in diameter, lined with suitable fire brick, into which coal is fed from the top. The apparatus is carefully constructed so that it can be made

air-tight while in operation. In operation the producer is kept filled with coal for practically the entire depth, the depth of the fire above the grate being comparatively thin. The gas generated by the combustion of coal passes up from the producer through various pipes and traps to the scrubber, where it is washed and cleansed and passes thence to the engine. The fires are cleaned by use of long poke bars introduced at the top of the producer passing down close to the lining to the bottom of the grate. Upon the skill of the operator in cleaning the fire each morning depends in a considerable degree the economy to be obtained through practice, and our engineers have noticed a rapid improvement in their results after a few weeks' experience.

The prime movers consist of two 65 h. p. Nash Gas Engines, manufactured by the National Meter Company, of New York. These engines are of the vertical, three cylinder, four cycle type and are built of good material. They are guaranteed to deliver 65 brake h. p. upon a consumption of 10,500 B. t. u. at full load and 260 revolutions per minute.

The pumping equipment consists of two 9x12 triplex power pumps of double acting type, furnished by the Goulds Manufacturing Co., of Seneca Falls, N. Y. They each have a capacity of 1,000,000 gallons in 24 hours, with the engine running at the speed above stated.

The equipment is in duplicate throughout, reducing the possibility of a shut down through injury to machinery to a minimum.

This, however, entailed considerable hard work and required the constant attention of one man. To obviate this difficulty, and to give the operator opportunity to attend to other duties while the fire was being "blown," a Backus water motor was installed and belt-connected with a blower fan which was piped to each producer. The water motor takes its supply from the main and has worked efficiently and cut down the manual labor of the operation of the plant to a very large degree.

The air is compressed by means of two air pumps which are belt-connected to shafting run from the engine. There is also an emergency connection between one air pump and the water motor above referred to so that in the event of a complete loss of compressed air with the engines idle, a fresh supply can be quickly compressed into any tank. In addition to the belt and shafting for the air pumps there is also a line of shafting and belting to operate the scrubbers and producers, and a line of shafting and belting which operates a small Goulds pump, whose function is to pump all dirty water and sewage from a tight concrete cess-pool to a filter basin about a quarter of a mile from the pumping station and off of the water shed of Gravel Pond. All this belting and shafting and gas piping is so arranged that either engine may be operated from either producer.

The pumps are set in motion by opening the by-pass of the pump and pulling in the clutch between the pump and the engine. This sets the pump in motion, but not against its full load and not forcing water through the mains. The by-pass is then gradually closed. By this means the pump and engine receive their load just as gradually as may be desired. The full load is given to the machinery when the by-pass is entirely closed. The pumps are connected with a common suction line and a common force main. They are made independent of the force main and each other by check valves close to each pump and the current of water is further checked by a large check valve on the main line.

The force main is also provided with an 18-inch Premier meter within the building. This meter reads directly the number of gallons pumped, upon a properly graduated dial, and together with the pipe is laid in a roomy conduit through the station and is readily accessible for reading. The suction line extends from the pump, running to a pump well near the pumping station and close to the shore of the Pond. This well consists of concrete structure below the ground, surmounted by a small brick building with concrete roof. The well is 10 feet square and carried to a depth of 12 feet.

The suction pipe extends to within 2 feet of the bottom of this well and is provided with a foot-valve, having a wire screen of 4 meshes to the inch. The well itself is divided by two sets of screens extending its entire depth. These screens are made in sections light enough to be readily handled and are made of cypress frames and copper wire having six meshes to the inch. These being in duplicate, it is always possible to remove a set for cleaning without allowing any objectionable matter to enter the suction main. From this well the main extends about 130 feet into the pond

and terminates with an upturned end having its top about 9 feet below the surface of the pond. This end is covered with a screen having 1 inch meshes. At the well is provided a gate controlling the inflow of water. The sub-structure of the well and intake pipe were constructed by Charles N. Taylor. The outer 70 feet of the intake pipe were laid by making up the pipe upon the ice directly over the location it was intended to occupy, closing the ends and after sawing away the ice from it lowering the pipe to the bottom. This operation was successfully performed. The balance of the pipe from the well to the end of that sunk through the ice was laid in sections by the construction of a coffer dam.

Plans were prepared and bids obtained for the construction of a concrete dam between Gravel Pond and Round Pond to control the flow of water from them and to isolate Gravel Pond. Messrs. Morley, Flatley & Co., of Manchester were the successful bidders, and the dam was constructed by them. It consists of a concrete wall 2 feet in thickness and extending through the muck into a bottom of hardpan. A channel way is provided near the center with wing walls, and a 24-inch gate is set in the dam between these wing walls at a suitable depth below the surface. The crest of the spill way was made at an elevation of 50.82 feet above mean low water, which raised the level of Gravel Pond by one foot over its normal high water level. This adds about 15,160,000 gallons to the storage capacity of the Pond.

Work was commenced on the concrete standpipe by Simpson Brothers Corporation, about the middle of March and after the construction of a cable railway from the base to the top of the hill and the erection of sheds, equipment, etc., the work on the concrete structure was commenced. This was carried on as rapidly as possible and with great care. The structure is 50 feet in diameter and 72 feet 6 inches from the inside base to the top of side walls. It is surrounded by a balcony and railing at the top and covered with tile roof built by the Guastavino people under their letters patent. There is a circular iron ladder on the outside of the structure and a galvanized iron ladder on the inside. The walls are 20 inches thick at the base and 12 inches at the top. The structure is reinforced by round steel rods laid horizontally in the walls. These are so designed and placed in the structure that with the standpipe full of water, the tension on them shall not exceed 12,000 pounds per square inch. This is in accordance with conservative design and allows a liberal factor of safety. The standpipe is designed to be filled with water to a depth of 70 feet and when full contains 1,028,090 gallons of water. It contains for each foot 14,687 gallons of water. Water is forced into the standpipe through a 16-inch pipe which extends to within 10 feet of high water. Near the base of the standpipe are provided three 10-inch check valves opening into the rising pipe. Water entering the standpipe closes these check valves and passes up through the rising pipe and is there discharged into the tank. This, as well as giving a chance for aerating the water, gives a constant head against which the pumps must work and also makes it possible, should the standpipe be empty or nearly so, to provide the high pressure due to 60 feet of water in the standpipe. When the pumps are not in operation the check valves at the bottom are opened by the pressure of water. Supply is thus taken from the bottom after entering at the top. This is practically the same method as has been employed in the old iron standpipe for the last eighteen years, and which has given entirely satisfactory results. The standpipe was first filled with water July 23-25, 1909, and was closely watched for evidences of leaking. The structure showed considerable dampness on being filled but no leaks of any consequence appeared until the middle of August, when small leaks appeared on the southwest portion. These were mainly at points about 30 inches from the base and about 12 feet from the base. By the 31st of August they had so increased, that, while not wasting water to any appreciable extent, it was deemed advisable to empty the tower and ascertain the cause. This was done and, beyond fine hair cracks on the inside of the tower opposite the leaks, nothing was found. A temporary treatment was given this area and the standpipe again filled in about ten days. The same leaks appeared again and the lower one increased considerably, but inasmuch as the consumption of water was at its height and a great deal of inconvenience would be caused to houses on the higher hills by the emptying of the new standpipe at this time, and furthermore, inasmuch as in the opinion

of the contractors and the engineer, no damage was being done to the structure, it was decided to keep the tower in operation until such time as the Home plant should be remodelled and in operation, when permanent repairs would be made. This course was agreed upon, and on October 30 the new standpipe was again emptied and carefuly examined and repairs were made by Simpson Brothers Corporation, and the standpipe again filled with water on November 24. At that time and since then, it appears to be practically water-tight. It is not an unusual thing for structures of this character to develop slight leaks at the commencement of their use, but after having been in use for some period of time they generally become to all practical purposes water-tight. I consider the structure to be an excellent piece of work with the exception of the above leaks, and this trouble I have not the slightest doubt has been practically overcome. It may be of interest to know that this standpipe contains 1,327 tons of concrete and 120 tons of steel.

High service was turned on to the mains on the 2d of August, and beyond a few leaks in the mains due to some weak pipe and a few breaks in service due to worn out pipe in every case, there have been, contrary to general expectation, no serious results. The high pressure has been tried by the firemen and the results would seem to indicate that the high service had added very measurably to the fire fighting assets of the town. It also makes available the higher hills of the town for building purposes, and present indications are that many of these hills will in the course of a few years be built upon.

Work was commenced in the early part of August upon the dismantling of the Home station and refitting it with the new type of machinery. The equipment of this station is similar to that at Gravel Pond with the exception that the producers and engines in the Home plant are of 50 h. p. and pumps have a capacity of 750,000 gallons. The same general arrangement is followed here as at Gravel Pond, and the same equipment for "blowing" fires and pumping air has been provided. The building has been provided with new concrete floors and an elevated reinforced concrete floor has been constructed in the old boiler room at the height of the top of the producers. An elevated roadway has been built from the driveway to the Superintendent's house upon which coal is carted directly onto this coal floor. By this means the handling of the coal is reduced to a minimum.

Outside the building and in a concrete subway a 12-inch Premier meter has been set. The operation of this plant is identical with that at Gravel Pond.

The guarantees of fuel economy from the three contractors for machinery were such that at full load and on a ten-hour run with the plant lying idle or "standing over" for fourteen hours, a brake horse power could be generated at an expenditure of one pound of coal, of a heat value of at least 12,500 B. t. u.

The brake horse power used at the Pond upon high service, allowing an efficiency of 80 per cent. for the pumps, is 55 brake horse power. This is about 85 per cent. of the full load and as the plant runs at its greatest economy at full load, the full economy of the guarantee is not obtained.

The plant, however, has as a result sufficient reserve power to save in the depreciation due to wear and tear.

We have not, as a rule, made ten-hour runs continuously, and as a shorter run means a longer "stand-over" and consequent consumption of coal without use of power, the economy is still further reduced from that of the guarantee.

Taking these two facts into consideration, it is my opinion that for an eight-hour run at 85 per cent. of full load, and consistently with the guarantee, the Pond plant should do its work at a coal consumption of about 1.25 to 1.30 pounds of coal per brake horse power.

Upon low service, the load is but about 40 brake horse power or only a little over half load and upon the basis of the guarantee it is my opinion that a fuel consumption of not over two pounds of coal per brake horse power should be obtained.

As the plant at the Pond has been run for the entire season and the Home plant for several weeks, it seems to me that if the results as to fuel economy obtained by our own operatives, new to the work, should be found to equal the guarantee made by the manufacturers, a fairer result would be obtained than if a very careful test were run by experts for the manufacturers, using the utmost refinements. It is true that the results of such a test would show far greater economy than the results obtained by us, but the conditions resulting from

actual running seem to be more fairly indicative of the actual everyday results which we may expect.

The fuel consumption at the Pond has varied from 1.8 to 2.4 pounds per brake horse power, at half load, and upon full load, from 1.25 to 1.65 pounds, including standover loss. The average fuel consumption for the summer, under all conditons, has been about 1.6 pounds per brake horse power, including standover losses and losses due to the many and various causes resulting from the inception of a new plant and the instruction of new men.

Whenever continuous runs have been made, however, where conditions of water consumption have been favorable, the fuel consumption has been kept within the limits of the guarantee.

The full load at the Home plant is but little less than the horse power supplied by the engine. Here the consumption has varied from 1.28 to 1.35 pounds per brake horse power, after the first two weeks of operation by our operatives.

I have not the slightest doubt that a careful and painstaking test would show that the two plants can be operated within the limits of the guarantee. With comparatively inexperienced operatives, we have obtained results in actual practice within the limits necessary for compliance with the guarantees. As the operatives become expert I think the fuel economy will be very satisfactory.

It is the desire of the various manufacturers of our equipment to make a most detailed and exhaustive test of one or the other of our plants, as they all state that our equipment is the most complete and well arranged of any of their similar installations, and they are very sure the results of such a test would establish a remarkably high record and be of considerable interest and value. The expense of such a test would be considerable and I do not consider it necessary for the acceptance of the machinery as, in my opinion, the results promised have been obtained in our actual practice.

The installation of Premier meters at each station makes it possible to measure exactly the amount of water sent into the mains at each station, and by comparing the total of these two meters, with the returns of the service meters, a valuable check and indication of waste may be obtained.

They are also excellent checks upon the performance of pumps, giving a quick and certain indication of slip.

It is of interest to note that up to the last of October, when the Pond plant was shut down, there had been pumped 46,332,000 gallons of water, partly into the old standpipe, and partly into the new, at an expenditure of 44 tons 651 pounds of coal, while in the year ending February 1, 1909, there were pumped at the Home plant, by the old machinery, 92,840,337 gallons into the old standpipe at an expenditure of 275 tons 400 pounds of coal. It is thus seen that we have this year in four and one-half months, pumped at Gravel Pond, about half of all the water pumped last year at the old Home plant, at an expenditure of about one-sixth the coal. Neglecting the fact that about one-half the water pumped from Gravel Pond was pumped to a higher elevation and against 35 pounds more pressure, it is seen that our new machinery has done its work at about one-third the fuel expense of the old.

In these two installations, the town has, without question, two of the best equipped and most efficient gas producer plants in this section of the country. They are of the best construction and well installed and should give excellent service.

With a double supply of water, each excellent, with pumping plants in duplicate, each plant in itself in duplicate, and with two water towers, it seems to me that Manchester is favored above any town of its size of which we know.

[Editorial Note. The above description of the new pumping plants at Manchester, Mass., is taken from Mr. Allen's last report. Some data concerning the plant, obtained from other sources and not credited to him therein, were published in the December number and the report itself, for which we are indebted to Mr. Allen, is so excellent that it is given almost in full.

The Evolution of a Pumping Station*

By Theodore A. Leisen, Louisville, Ky.

The title of the paper to be presented may seem somewhat ambiguous, and a word of explanation at the beginning will not be amiss. It is the intention of the writer to give a brief description of a pumping station built in the fifties, and equipped with what was then considered the highest development of the pumping engine, and also to describe the new pumping equipment which it is proposed to install in the same station, together with the necessary alterations to be made to the building to accommodate the newer type of engine. Considering this as a natural process of evolution, furnishes the reason for the title.

The pumping station under consideration was the first station built for the Louisville Water Company, Louisville, Ky., on the southerly bank of the Ohio River, in 1856-60. It was designed by Mr. T. H. Scowden, the first engineer of the Louisville Water Company, assisted by Mr. Charles Hermany, then assistant, and afterwards chief engineer of the company, and, as an example of classic architecture, it has never been surpassed in a structure of a similar nature. It is symmetrical in form and proportions, the pumping station proper occupying the central portion of the building, with wings at either end for the boiler houses. The central facade is of classic design, with four massive Corinthian columns extending from the portico to the pediment of the roof. The two boiler-room wings harmonize perfectly with the main building, and in a semi-detached position beyond those wings are the two brick stacks, seemingly also a part of the building. Every feature and detail of the station is in perfect accord and harmony with the building in its entirety.

Special emphasis is laid on the architectural features of this station for the reason that this is a characteristic too frequently found wanting in structures designed for such utilitarian purposes as an engine and boiler house. It is greatly to be regretted that the underlying principle exhibited in the design of this station, if not the design itself, should not be more universally applied in the construction of buildings of this class.

The pump room is 52 feet long by 42 feet in width, and the pump-well, occupying the northerly end of this space, is 22 feet by 39 feet, and extends to a depth of 45 feet below the main floor, and three feet below the extreme low-water level of the Ohio River at that point. Within this well the water rises and falls with the varying stages of the river, completely submerging the pump end of the engine at high water. Taking the low stage of the river as zero, the elevation of the main floor of the station is 43.0, and as the highest record of flood stage is 45.6, the whole main floor has been submerged at times to a depth of over 30 inches. All of these conditions had to be taken into consideration in the designing of the contemplated alterations.

The present mechanical equipment consists of two Cornish pumping engines, designed to operate singly or in unison, each having a rated capacity of six million gallons in twenty-four hours, against a total dynamic head of about 190 feet. The dimensions of the principal parts of the engines and pumps are as follows: Steam cylinder, 70 inches diameter and 10 feet stroke; two pairs of walking beams, 32 feet long by 6 feet 9 inches deep at the center, weighing 42 tons per pair; pump plungers, 36 inches in diameter and 10 feet stroke; weight of counterweights on one plunger, 49 tons.

The boiler plant is in duplicate, each set consisting of a battery of three internally-fired, single-flue Cornish boilers, 72 inches in diameter by 30 feet in length, with a flue 46 inches in diameter the full length of the boiler.

The cost of the station and engines, including amounts expended for alterations and improvements during the early years of their operation, was as follows:

Engine and boiler house and chimneys	$120,000.00
Engines and boilers	150,000.00
Total	$270,000.00

The erection of these pumps and boilers was completed in 1860, and up to 1893 they were practically the sole dependence of the city of Louisville for its municipal water supply, and they

*A paper before the Indiana Engineering Society.

remained in regular service until 1909, with occasional interruptions for repairs and alterations. They are still capable of service in an emergency.

As the Cornish pump is an antiquated and almost obsolete type of pumping engine, with which engineers of this generation are not generally familiar, a brief description is here ventured:

These engines are of the vertical type, having long overhead walking beams, at one end of which are attached the connecting rods of the steam pistons, and at the other end the connections to the pump plungers. The steam cylinder is single acting, the steam being admitted at the upper end only. As the piston is forced down by the steam pressure the pump plunger is raised, filling the pump chamber on the up stroke. The downward stroke is accomplished by the dead weight of the heavily counterweighted plunger, which is massive enough to overcome the resistance of the given volume and pressure of water, and to force it up through the pump main against the given dynamic head. The sole function of the steam pressure is to raise the weighted plunger, the force of gravity accomplishing the rest, except in so far as it may be aided by the vacuum produced by condensation.

There can, of course, be no variable cut-off, the steam being supplied for the full length of the stroke, and in consequence the resultant efficiency can not come within the category of "high duty."

The average duty developed by these pumps during the last year's operation was 45 million foot-pounds per hundred pounds of coal. The boilers were operated under twenty-eight pounds gauge pressure.

The two engines occupy practically every square foot of available floor space in the engine room, and each battery of boilers takes up the space in the boiler room from wall to wall, with a limited portion remaining in front for firing room.

The average daily consumption of water in Louisville is about twenty-three million, and the maximum twenty-seven million gallons. In the new pumping station, which is now the one in constant use, there are two modern pumping engines, one a sixteen-million-gallon Leavitt and the other a twenty-four-million-gallon Allis-Chalmers. Should either of these pumps be thrown out of commission for any extended time, the other would not have sufficient capacity to keep pace with the requirements of the city, and in consequence a safe and efficient reserve is desirable. The only reserves at present are these old Cornish pumps in the station which it is proposed to remodel, and, as they are inefficient, uneconomical and of insufficient capacity, it becomes necessary either to replace them or construct and equip an entirely new station. After mature consideration the former course was adopted, for reasons which will be fully outlined hereafter.

When this question of additional pumpage capacity was broached, a problem was presented as to the type of pumping engine to be considered and the means for housing it. The foundations of the old station were not believed to have the requisite stability for a vertical triple-expansion engine, and neither was the available space sufficient for a thirty-million-gallon engine of this type, this being the capacity considered advisable. On the other hand, the deep and somewhat contracted pump pit lent itself admirably to a vertical shaft centrifugal pump, having the motive power on the main floor forty-odd feet above the pump.

After a careful comparison of the initial cost, cost of operation and relative efficiency of a new pumping station equipped with one thirty-million-gallon vertical self-contained triple-expansion crank-and-fly-wheel pumping engine (with space for a second unit), and the utilization of the old station, with necessary alterations for adapting it to a multi-stage centrifugal pump, the latter proposition appeared to have so much in its favor as to leave no doubt as to the expediency of its adoption.

The next points for consideration were, the form of pump best suited to the conditions encountered in the old station; the motive power to be used in operating the pump, and the character of the alterations to make the station conform to the requirements of the new machinery.

In order to convert the pump pit into a dry well, it was decided to fill with concrete the bottom of the pit from its present depth of three feet below datum (extreme low water) to a level of eight feet above, making a mass of concrete over the whole bottom eleven feet thick, and also to interline the walls with concrete eighteen inches in thickness, reinforced where necessary, and thoroughly tied into the old structure through the various openings in the walls, which will be filled up also. The use of this apparently excessive quantity of concrete was resorted to in order to increase the stability of the whole structure and pro-

vide against the added upward pressure of the water due to preventing its admission into the well. To guard against the possibility of the station ever being flooded, the main floor will be raised three feet, bringing it to a level six inches higher than the highest flood stage of the Ohio River in fifty years.

For the purpose of further future development, it was decided to make the layout so as to provide for duplicating the proposed installation, particularly as the suction openings and discharge pipes for two pumps already existed, and on this account, and also because of the desire to maintain above the possible range of high water all portions of the machinery which might be rendered inoperative by excessive floods, the vertical type was found to be the only one which would meet these conditions and fit the limited space available.

Having definitely decided on a vertical-shaft pump, the choice of motive power for driving it was confined to either an electric motor or a vertical steam turbine, and after due consideration of all the points at issue the steam turbine was selected.

The plant as finally laid out consists, briefly, of a vertical trirotor centrifugal pump, having a 42-inch suction and a 36-inch discharge, with a capacity of 30,000,000 gallons in 24 hours, placed at the bottom of the remodeled dry pump pit, the center of the suction end of the pump being 12 feet above extreme low water. The vertical steam turbine will be placed on the main engine floor of the station, at an elevation of 46 feet above datum, or three feet higher than the present floor, and six inches above the highest recorded flood stage of the river, and the shaft of the turbine will be direct-connected to the pump, the length of the shaft between the turbine and pump couplings being 26 feet.

The turbine is rated at 1500 k.w., and it and the pump are designed to operate at a maximum speed of 1500 revolutions per minute when delivering 30,000,000 gallons of water in 24 hours against a maximum head, including suction and friction, of 190 feet. It may be noted here that future low stages of the river will probably be six to eight feet above former extreme low water, on account of the new government dam recently brought into service, and the maximum suction lift of the pump, therefore, will seldom exceed six feet, and for the greater portion of the time there will be no suction lift at all.

A surface condenser of the water works type will be placed on the suction line, through which the full volume of water must pass to reach the pump, the exhaust from the turbine being carried down in an almost vertical line to the condenser. The water of condensation will be conveyed from the condenser hot-well to a hot-well in the boiler room by means of a small steam-turbine-driven pump. A rotative dry vacuum pump will be placed on the main engine floor, and this, with the turbine proper, will be the only machine parts visible on this floor.

A marked contrast is presented between the space occupied on the floor of the station, and also overhead and underneath, by the old Cornish engines and the new turbine-driven units, and the comparison is still more striking when it is realized that the two Cornish pumps are rated to pump 12,000,000 gallons, while the two turbine-driven centrifugal pumps, if a second one should be installed, would have a capacity of 60,000,000 gallons, or five times greater than the old pumps.

The boiler plant will consist of one nominal six-hundred-horsepower Stirling boiler, in single setting, equipped with the new Jones underfeed stokers, and an induced-draft apparatus which is designed to supplement the old stack, it being too small to take care of the gases of combustion from a boiler of this size. A suspended superheater will be installed also, of sufficient capacity to increase the temperature of the steam 100 degrees above boiler temperature. The steam pressure will be 190 pounds at the gauge.

Plans and specifications were prepared and bids received on the above described equipment on October 11, 1910, and contracts were executed shortly thereafter. The contract prices were as follows:

One 30-000,000-gallon vertical steam-turbine-driven pump, including condenser, hot-well pump, dry vacuum pump, and all piping and connections	$40,000.00
One 600-horsepower boiler, in single setting, equipped with new Jones underfeed stoker, superheaters, induced draft apparatus, and enameled brick setting	15,880.00
Total	$55,880.00

The contract for the pump and turbine was let to Henry R. Worthington, although the turbine will be built by

the General Electric Company. The boiler contract was made with the Babcock & Wilcox Company for a Stirling boiler.

It is estimated that the cost of remodeling the station and installing certain auxiliaries will amount to about $15,000, so that the total cost of the new equipment and station may be assumed at $70,000.00.

The specifications call for a guaranteed duty of not less than 100,000,000 foot-pounds per 1000 pounds of dry steam, to be delivered at the throttle at 180 pounds gauge pressure and 100 degrees superheat. The vacuum shall be not less than 38 inches, and the combined boiler and stoker efficiency not less than 72 per cent. The builders of the pump and turbine confidently expect to develop on trial a duty of 110,000,000 foot-pounds.

In making calculations to determine the relative advantages between a new pumping station fitted with the best type of high-duty engines, and the old station equipped with the centrifugal pump, several facts were self-evident: If a new station were built, it should be large enough to accommodate a second unit at some future time, and if so built would cost approximately $400,000, basing this estimate on the cost of the present Station No. 2, which cost over $400,000, although considerably smaller than would be required for two thirty-million pumps. On the other hand, the old station already exists, and could be remodeled for about 4 per cent. of the cost of the new station, and the cost of the centrifugal pump would be about one-fourth that of the high duty engine.

Starting with these facts, the following tabulated statement was prepared, showing the comparison when interest and depreciation are taken into consideration:

	High Duty Pumping Engine.	Centrifugal Pump.
Cost of Installation.		
Pumping station and boiler house	$400,000.00	$14,120.00
30,000,000-gallon pump	175,000.00	40,000.00
Boilers	15,000.00	15,880.00
Total	$590,000.00	$70,000.00
Conditions of Operation.		
Duty per 1000 lbs. steam	165,000,000 ft. lbs.	99,000,000 ft. lbs.
Net water horsepower	1,000 h. p.	1,000 h. p.
Steam per horsepower-hour	12 lbs.	20 lbs.
Coal consumed per year (320 days)...	5,100 tons	8,520 tons
Cost of Operation.		
Interest on investment, 4 per cent.....	$23,600.00	$2,800.00
Depreciation H. D. pump, 3 per cent...	5,250.00	.....
Depreciation Cent. pump, 4 per cent...	.....	1,600.00
Depreciation boilers, 4 per cent.....	600.00	600.00
Coal per year at $1.25 per ton.....	6,375.00	10,650.00
Oil and supplies	1,075.00	550.00
Labor	12,600.00	12,000.00
Total	$49,500.00	$28,200.00

Assuming that these figures are reasonably correct as an estimate, it shows a balance in favor of the centrifugal pump of over $21,000 per year—an amount which if deposited in a sinking fund would be nearly sufficient at the end of three years to repay in full the original investment.

It is not intended at this time to advance the general theory that the centrifugal pump will supplant the high-duty pumping engine, although some arguments along this line may be set forth later. At present it is merely the desire to demonstrate the special advantages which the centrifugal pump possesses for this particular case, and to trace the history of this pumping station from its beginning.

Ornamental Street Lighting at Cincinnati, Ohio

By an Editorial Correspondent

PODUNKTOWN on Bear Hollow Creek and Cincinnati on the Ohio are "sisters under the skin" when the questions of advanced street lighting are brought before the citizens. The abstract proposition of improved street lighting is one which is acknowledged by all cities to be for the best interests, both financially and otherwise, of the municipality. But with the question of what constitutes the best mode of lighting or who shall pay for its attainment, comes disagreement, dissension, and often failure for the entire proposition. With few exceptions the average business man, commercial club, or civic improvement league will commend the cause of better street illumination, dwelling on its value as an advertising factor for the city, and its elevating effect on the whole cause of civic beauty; and with a correspondingly few exceptions all the "sound and fury" of the "booster" movement is brought to bear on the local "grasping corporation" which controls the lighting field. They offer, with few exceptions, no mode of attaining the new system, and, in fact, seldom even have in mind a definite idea of what they most desire as to type of light. They are of one mind only in the fact that they desire something better.

Cincinnati faced the same problem as have other cities, and as many others will do in the future; but with the result that through an application of business principles, the proposition was satisfactorily solved. The installation of the boulevard lighting system in Indianapolis brought the matter to the attention of the Cincinnati Business Men's Club, and it was decided to obtain the best in street illumination that was to be had. Here all unity of action ceased. There were almost as many ideas of types and forms of lights and standards as there were individuals concerned in the movement; and the proposed steps towards acquiring the lights were also various and varied. In the latter case, however, it was commonly held that the Union Gas and Electric Company should "be made" to make all experiments and bear the responsibility of the movement. Up to this point the case of Cincinnati is identical with that of hundreds of others with a like object in view. It remained for one man to devise the means of handling the situation.

This man, Mr. H. L. Linch, a local attorney, realized that the public service corporation would be only too glad to accede to any reasonable business proposition which would give the city what it desired. That the Union Gas and Electric Company held this attitude has since been proven by its action in meeting the city more than half way and by the aid and assistance rendered by Mr. Norman G. Keenan, its general manager.

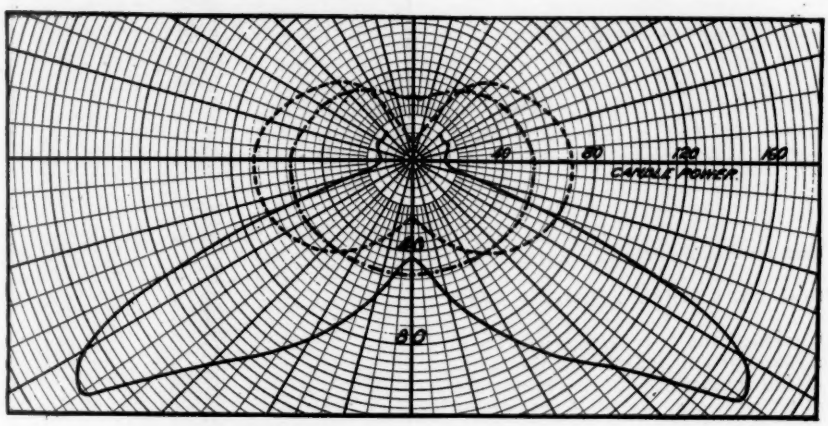
The proposition which Mr. Linch offered was for the business men and merchants to conduct the experiments, with a view to determining the best system to be adopted, and then, after the most approved type had been adopted, to proceed with its extension. In other words, he did not plan to approach the lighting company with the proposal that they should summarily adopt the new illuminating factors or bear the expense of their trial; but, rather, he offered to have the lights installed in a number of blocks on trial, the same to be paid for by subscription among the owners and lessees along the frontage lighted. Realizing the soundness of his plan, the Business Men's Club placed Mr. Linch in sole charge of the movement, and to his energy and business ability is due the credit for the success of the undertaking.

When the matter of procuring subscriptions to the new system was started, the case of Cincinnati was again identical with that of other cities, both large and small. The ever-present practical business man, who was glad to shout with the crowd when the subject was discussed in the abstract, subsided into silence or disapproval when he was asked to pay his portion of the expense. In some cases the aforementioned practical business man insisted that unless the ornamental standards were located so as to give him the benefit of a larger share of illumination than his neighbors, he would refuse to subscribe. These troubles, which are by no means peculiar to Cincinnati, were finally satisfactorily adjusted, and a number of different systems of boulevard lights were installed and given a thorough trial, it being agreed that the latter system was by far the best for

ORNAMENTAL LIGHTING, EAGE STREET, CINCINNATI, O.

that portion of the city known as the "underground district," which is practically the business section.

As a result of these trials a standard light has been adopted, which will, no doubt, be extended throughout the "underground" district." The accompanying photograph shows the Race Street experimental installation of Holophane lights on posts of the Electric Railway Equipment Company of Cincinnati, Ohio, which has proven so entirely satisfactory. It is as great an advancement over the ball globe boulevard system as the latter was over the corner arc lamps. For the development of this improved boulevard light all credit is due to Mr. Arthur J. Sweet, a widely known illuminating engineer and an authority on street lighting.



— — — OPAL BALL
····· SAND-BLASTED BALL
——— HOLOPHANE STREET LIGHTING UNIT NO. 591
LAMP USED - 100 WATT, 80 C.P. 110 VOLTS

1. COMPARATIVE CURVES OF LIGHT DISTRIBUTION.

Mr. Sweet describes his research work which led to the perfection of the present light in a paper given before the Franklin Institute in May, 1910. In speaking of the ideal which he seeks to attain, Mr. Sweet says:

"There are two results to be achieved in adequate street illumination, which are both of such paramount importance that it is properly a matter for individual opinion as to which should be ranked first. These are the avoidance of glare effect and the obtaining of an approximately uniform degree of illumination at all points along the course of the street, with higher intensities at street corners. These two results can only be obtained, the one by the correct solution of the allied problems of intrinsic brilliancy, total light flux and shadow contracts, the other by the correct solution of the problem of distribution."

That this solution of the problem of distribution has been attained will be seen by a reference to the accompanying authenticated curves shown in Figure 1. The first curve, as is noted in the legend, shows the candlepower measurements at various angles about a 100-watt tungsten light with an opal ball reflector. Note the amount of diffusion above the angle of about 55 or 60 degrees which may be assumed to be the "useful angle" for the usual spacing. The second curve is that of a 100-watt tungsten in a sand-blasted ball. Here again, though directed to a certain extent, the light is not properly distributed. The third curve shows the same lamp mounted in the new Holophane reflector, such as is shown in the Race Street installation. Here, as will be noted, the light is distributed so as to give the greatest intensity at the useful angle.

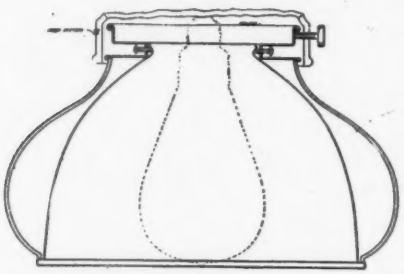
The result of this distribution is shown by Table I, in which the column "Horizontal Illumination" indicates the amount of light emitted in a horizontal direction—that is, along the surface of the street; and the column headed "Lumens" refers to the quantity of light. As will be noted, the horizontal illumination shows very little difference; in other words, there is an approximately uniform degree of illumination along the street surface.

Data on Holophane street lighting unit No. 591. General Electric clear

multiple, 100 watt, 80 candlepower. Mounting height, 12 feet.

Distance from Lamp Post Feet.	Angle Deg.	C. P.	Horizontal Illumination.	Lumens.
0	0	32.2	.223	.....
1.1	5	34.9	.24	2.21
3.3	15	52.2	.326	14.77
5.5	25	70	.361	32.41
8.4	35	90	.343	56.52
12	45	116	.285	89.78
17.6	55	146	.191	130.96
25.6	65	112	.058	111.10
45	75	60.8	.073	64.32
136.8	85	20.1	.001	21.92

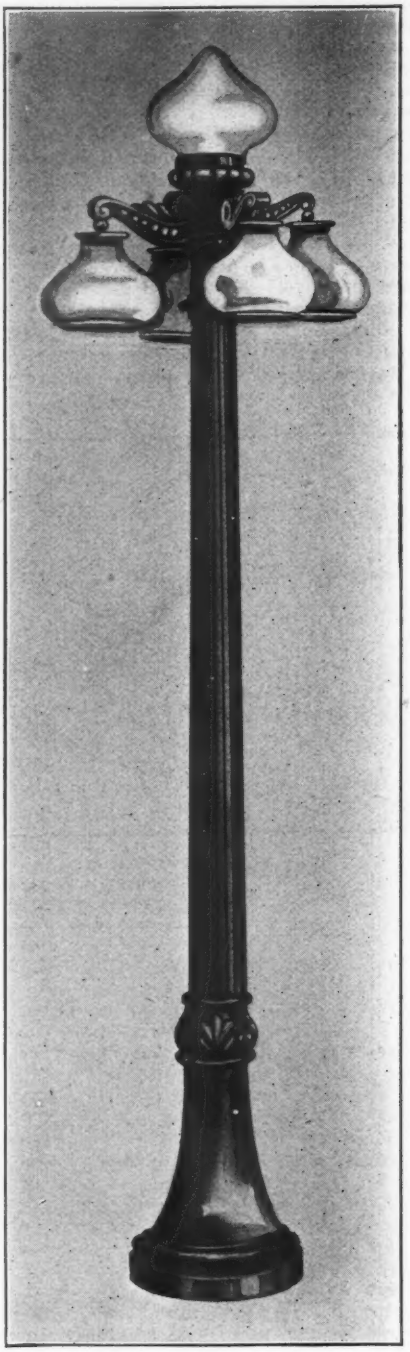
This uniformity of distribution is obtained by the use of a specially designed reflector shown in Figure 2.



2. HOLOPHANE STREET LIGHTING UNIT.

The inner of the two casings shown is of crystal prism glass. It embodies the same principles of directed distribution of light, so well known in the Holophane reflectors, which are in common use in interior illumination. The rays from the lamp at the center are reflected from prisms which are scientifically designed to direct it at angles which will give the maximum of efficiency with the minimum of loss by absorption or diffusion. The crystal glass by reason of its low absorption factor is particularly adapted to this use, and the careful adjustment of the prisms gives a distribution curve approaching the ideal. Covering the reflector is a protecting envelope of opal glass, which is flanged to the reflector so as to prevent the entrance of any dust or water, which would tend to distort the effect of the prisms in the reflector, and which gives an even more pleasing artistic effect than the ball globes.

The Race Street, Cincinnati, installation, the first of the improved systems, was lighted for the first time on February 6th, and the evident superiority of this over all previous lighting units has assured its early extension to



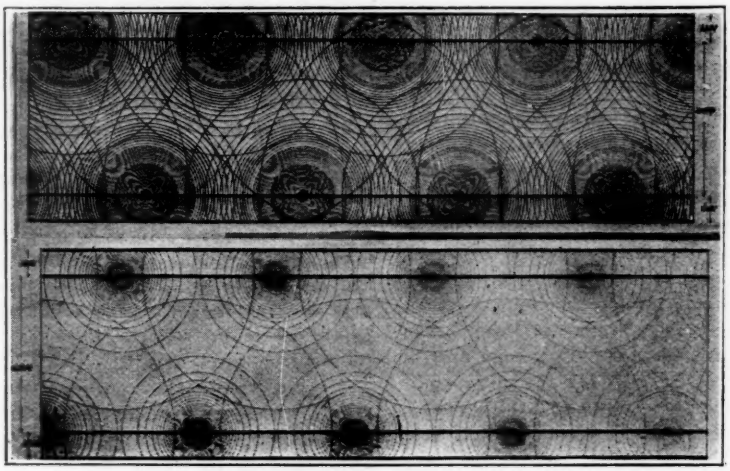
3. ORNAMENTAL STREET LIGHT STANDARD
Race Street, Cincinnati, O.

other streets. The good taste shown in the selection of standards which were consistent with the shape and relative size of the reflectors, may be noted from the accompanying photograph. The broad base tapering gracefully toward the top gives a most pleasing effect to the cluster of inverted reflectors and the melon shaped center globe. The wiring to these poles is all contained within the hollow shaft; and a switch is provided near the base, operated by a special key, allowing each unit to be cut off from the rest of the system at will. The general effect of the Race Street system is very pleasing, and is superior in every particular to anything that has yet been devised. The clusters are placed above the street at a height that does away with the "squat" appearance sometimes noted when the arms are so inverted as to make the globes pendant. The filaments of the lamps contained within the reflectors are practically invisible except when directly beneath them, and the opal envelopes give only a soft white glow which gives to the street the "White Way" effect without the excessive discomfort of the glare effect. This glare effect is not entirely eliminated but it is reduced to a degree making it practically negligible. In this connection it may be noted that research work is being carried on with a view to eliminating the glare entirely without sacrificing proper distribution. It is stated that with the present type of incandescent lamp, the entire elimination of glare is impossible. When the glare is entirely overcome perfection in street lighting will have been obtained.

One very noticeable feature of the Race Street system is the fact that objects beyond the lights and along the line of the street among them may be noted with distinctness. In addition to this, objects in darkened store windows may be viewed by the aid of the street lights alone. Along the line of the street there are no shadows, which would naturally be expected midway between two sources of light directing the rays downward by the aid of reflectors. Instead of this succession of excessive light and shadow, there is a uniformity of light along the entire street surface, of intensity sufficient to make newspaper print plainly visible at the greatest distance between lights. The greater intensity attained by the new lights as compared to the old ball globe may be noted from the accompanying photograph, which is practically a contour map of intensities, the circles being drawn through points of equal intensity of illumination, as shown by actual measurement. These diagrams were obtained from measurements made on a dirt street in Newark, Ohio, the same post and lamps being used in both instances, and the ordinary ball globes being replaced with Holophane reflectors in the second case.

That the new lights are satisfactory in Cincinnati is attested by the fact that specifications have been adopted and the contract let for forty blocks of the Holophane units.

ILLUMINATION CONTOURS FOR HOLOPHANE UNIT.



ILLUMINATION CONTOURS FOR BALL GLOBE UNIT.

EDITORIAL COMMENT

The Construction Number

THE CONSTRUCTION NUMBER.

This number of MUNICIPAL ENGINEERING speaks for itself as the largest and most comprehensive number of a municipal publication ever issued, both in the editorial and advertising sections. The call for material for both has been answered with equally gratifying results and the editor is glad to step aside for one issue to give place for the valuable and interesting data and information so fully supplied by our readers and correspondents. Indeed the wealth of material is so great that much must be held over for publication in future numbers.

The tables of data regarding public improvements in the cities of the country are unusually large and the information contained in them is fresh and authentic as it has all been gathered within the past six weeks and is received directly from the city engineers, superintendents of public works, of sewers, of water works, of electric light and other plants. Our thanks are due to these gentlemen for their contributions to the completeness of these tables, and we believe that the publication of these data will result in equal benefit to the industries and the municipalities with which they are connected.

We are equally well pleased with the contributions to the records of practical work, materials and apparatus which will be found throughout this number, but particularly in the departments "From Workers in the Field" and "Machinery and Trade." Engineers and others have taken time to give these descriptions of their work as contributions to the science and art of construction and receive their return several times over from the study of the records contributed by others in the same field. So many of these have been received that some are crowded over into next month's magazine, and we trust that now the ice is broken more of our readers will contribute to these collections of experiences so that all may profit equally thereby.

The usual departments may be somewhat restricted although the size of the magazine has been materially increased in an attempt to furnish in one number all the material so generously supplied. There are limits to the capacity of printing plants as well as to editorial office hours, however, and they insure that the following monthly numbers will not fall back from the high mark set by this special number.

Some editorial discussion of the data given in the tables will be found in connection with them. They are held until the last forms so that belated reports may be included up to the last minute. Doubtless many reports must wait for publication next month.

We congratulate our readers on the results to them of the generosity of our correspondents and fully appreciate the good opinion in which MUNICIPAL ENGINEERING must be held, that its requests for these contributions should be so fully met. It will continue to put forth all its efforts to keep its position at the head of the procession and to supply its readers with the latest and best information and discussions of engineering and construction problems.

All this points to a most prosperous year, and MUNICIPAL ENNGINEERING will do its share towards extending the influence of the good times as far as possible by bringing news of the work to be done to the knowledge of those who can do it. While this March number is exceptional, in that it gives estimates of work for the whole year, the following numbers will supply the details as projects are prepared for submission to bidders.

THE QUESTION DEPARTMENT

Names of City Building Inspectors.

I am anxious to secure the names and addresses of the Inspectors of Buildings of all American and Canadian cities where there is a Department of Buildings. Can you furnish these, and if not can you inform me where I may find them?

R. F. D., Louisville, Ky.

The writer knows of no such list and inquiry of the secretary of the International Society of State and Municipal Building Commissioners and Inspectors, 4200 Piney Branch Road, Washington, D. C.,. brings the information that that organization finds it best to address mail not to individuals who may be on the lists as building inspectors, but to "The Building Inspector," changes being so frequent that no list can be up to date for any length of time.

Ordinances Concerning Fireworks.

We would be pleased to receive a copy or copies of ordinances prohibiting fireworks in municipalities, or in other words, providing for a sane Fourth of July.

W. E. ARCHER,
City Attorney, Horton, Kan.

Section 4 of Article IX of the police regulations of the District of Columbia reads as follows: "No firecracker, squib or other fireworks of any kind shall be sold and delivered, discharged and set off within the city of Washington or the fire limits of the District of Columbia, or in the more densely populated portions of said District; provided, however, on occasion of public celebration and exhibition, fireworks may be discharged or set off on special permits issued by the commissioners, defining the time, place, storage, and such other conditions as they may deem necessary to the public safety. No gun, air gun, rifle, air rifle, pistol, revolver, or other firearm, cannon or torpedo shall be discharged or set off within the city of Washington or the fire limits of the District of Columbia without a special written permit therefor from the mayor and superintendent of police, nor within 500 yards of the Potomac river, Eastern branch of Anacostia river, Rock creek or any public road, highway, schoolhouse, building or buildings, shed, barn, outhouse, public park, reservation, graveyard or burial place, playground, golf course, tennis court, picnic ground, camp ground, or any place where people are accustomed to congregate, inclosure for stock, railroad tracks, outside of such fire limits for the District of Columbia, without the written consent of the owner or occupant thereof and a special written permit from the mayor and superintendent of police. Provided, that this section shall not apply to licensed shooting galleries, between 6 o'clock a. m. and midnight of the secular days of the week, nor to discharge of firearms or explosives in a performance conducted in or at a regular licensed theater or show." Passed in 1908.

Cleveland, O., has an ordinance, passed by the city council in 1908, Section 1 of which provides "that no person, firm, or corporation shall within the city sell, offer for sale, or have in his or its possession or custody any toy pistol, squib, rocket, cracker, or roman candle, or fire balloon, or other combustible fireworks, or any article for the making of a pyrotechnic display; provided that nothing in this section contained shall be construed as to prohibit the board of public service from giving pyrotechnical displays of fireworks in the public parks whenever said board is thereunto directed by resolution of council." Section 2 provides "that any person violating any of the provisions of (sections named) shall on conviction thereof be fined in any sum not exceeding $100 or imprisoned in the workhouse not exceeding 30 days, or both, at the discretion of the court." Section 3 repeals sections of previous ordinances and Section 4 prescribes time of taking effect.

An ordinance of Indianapolis, Ind., passed in 1910, makes similar provisions but excepts the Fourth of July from 4 a. m. to midnight from the provisions of the ordinance, which makes the city safe and sane for all the year except that one day.

The board of aldermen of Springfield, Mass., passed an order in January, 1910, providing that fireworks may be sold "on the two week-days prior to Independence Day, between the hours of 4 a. m. and 11 p. m., and that they may be sold from 4 a. m. to 10 p. m. on Independence Day. They may be used on Independence Day between the hours of 4 a. m. and 9 a. m. and from 6 p. m. to 7:30 p. m., provided also that this order shall not prevent the use of fireworks from 7:30 p. m. to 10 p. m. intended for display, spectacle or illumination only. And it is hereby further ordered that no explosives of any kind whatever shall be used or placed on the tracks of any railway company, and that no explosives of any character shall be used or discharged within 500 yards of any concert, exhibition or exercises being conducted at the time under the auspices of the Independence Day Association. It shall be unlawful for any person at any time to discharge or set off anywhere

within the limits of the city, or to have in his possession for such purposes, any toy pistol or gun requiring or in which may be used any blank cartridge or caps other than small paper caps or firecrackers; any toy cannon requiring or in which may be used explosives other than firecrackers or small paper caps; any detonating canes, blank cartridge, firecrackers exceeding 3½ inches in length and one-half inch in diameter, any firecrackers containing any explosives more powerful than black gunpowder, any torpedo exceeding three-quarters of an inch in diameter, any substance consisting of chlorate of potash and sulphur, or containing picric acid or picrates or any device for discharging or exploding such substance. It shall be unlawful for any person, firm or corporation to sell, offer or expose for sale, to loan or give away to any retail dealer, consumer or user, located within the city, any firearm or explosive whose use is prohibited in the preceding paragraph. No provision in this order shall be construed to prohibit the discharge of a pistol or other firearm necessary or proper in carrying out any part of the Independence Day Association program, or to prohibit the necessary or proper use of pistol or firearm at any theatrical performance."

Form of Grade-Book for Small City.

What would be the best way to make a grade-book for a town of about 5,000 people, showing the grades at the street corners and alleys?

SUBSCRIBER, Northumberland, Pa.

Will our readers send sample pages and descriptions of such books? They will be reproduced with due credit and will help many engineers in the smaller cities.

In order to lay out grades intelligently a contour map of the city should be made. This may be based on lines of levels run along the centers of the streets with points every 50 feet or 100 feet, according to the uniformity of slope, and intermediates at every change in slope. If there is much slope across the street levels should also be run along each curb or property line or both, or cross-sections may be made at each of the points on the center line. Some points in the lots each side of the street may also be necessary in order to fit the street grades to the adjoining property. Profiles of all these streets will be made, and the contour map and profiles must be studied together to locate the elevations of streets at each intersection and at each change in gradient.

When the grades of the streets are established, they should be recorded on the contour map with the detail possible on the scale of that map, and the lines of the new grades should be drawn on the profiles. In addition the figures designating the elevations at intersections of streets and at changes of grade shauld be recorded on the profiles.

In many cases these maps and profiles can serve as the records of grades, and in such case should be mounted on cloth and cut into convenient lengths for binding in books or filing in drawers.

Where the ground is rough, or where property owners put in their own sidewalks or curbs or both, these records will not be sufficient. They should be supplemented by detailed maps of the streets, which will give not only the record of the grades along the center of the street, but the grades along the curb lines and along the property lines. These elevations should be given at each station along the center line and at each intersection of a property line with the side line of the street. Ordinarily these elevations on the side and curb lines of the streets are not put on the record until the sidewalks or curb has been ordered in or stakes have been set for it, so that the record shows the work actually done rather than the plan on which it should be set out. This is the best method, if the profiles and maps by which the system of grades was laid out are sufficiently detailed to enable a new engineer to determine easily the proper elevation for any property owner's curb or property line.

These plats of the streets must be on large enough scale to show all the data, and may also contain cross-sections where there are special difficulties. The scale depends upon the amount of data required, being much less in a level city with regular sized blocks and lots than in a city with many changes in slopes, steep side and longitudinal slopes and consequent irregularities in alignment and width of streets, lengths and areas of blocks and lots.

When such detailed grade maps or plats are desirable they can be filed or bound in books of size sufficient to show on each sheet at least one long block with the street intersections at each end. By cutting the street into such sections, repeating, if desired, the intersections on the consecutive sheets, and indexing by names of cross streets or by house numbers, any desired section can be found easily and the records can be kept accurately and fully. If bound in books the leaves should be removable with little difficulty so that unusual changes, requiring complete revision of a sheet or more, can be made on new sheets and inserted in their proper places.

Another method of keeping these details would be to place them on cards without plats or with small plats of the fronts of lots only, showing on each card the details of elevations of lot lines, curbs, crown of streets, etc., for a single lot. The data for this information would be obtained from the contour map and profiles and cards might be made for each lot showing what should be done, with notations made when the work is ac-

tually done. There would be less useless work if the cards were made out only when the work is ordered or is done, though there might be more danger of errors if the records were kept in this way than if all the cards on a given block were made out at the same time, whether the work indicated had been done or not. These cards may be filed in order along the street, by house numbers, by lot numbers, by owners' names, or by two or more methods with cross references to the card containing the full information, as would be most in conformity with local customs.

If the city does all the improvement work, including grading, laying sidewalks, setting curb, paving streets, etc., such detailed records are not ordinarily necessary. The completed records on plats of the completed work are then sufficient. These should be made on sheets of standard sizes, filed systematically and thoroughly indexed, and will then be sufficient records for all ordinary purposes.

Books on City and Township Planning.

Do you know of any publication that treats of the designing of cities and laying out of town sites.

It would be quite a favor if you would kindly send me the address.

G. H. M., New Westminster, B. C.

The following books will be found of interest: Robinson's "Improvement of Towns and Cities" ($1.25) and "Modern Civic Art" ($1.25); Zueblin's "American Municipal Progress" ($1.25); Baker's "Municipal Engineering and Sanitation" ($1.25); Goodhue's "Municipal Improvements" ($1.50). The most satisfactory publication in this line is *The Town Planning Review*, the quarterly journal of the department of civic design of the school of architecture of the University of Liverpool, which is published by the university at 2 shillings 6 pence per number.

Breed's, Johnson's or Gillespie's "Surveying" (each about $3) will give methods of doing the field work and preparing for the layout.

Articles on Municipal Ownership and Operation of Public Service Utilities.

I would like to have you give me a record from your files and also other papers that deal with such matters in which I may find articles for and against municipal ownership and operation.

R., Macon, Ga.

The most extensive and detailed study of this question is contained in the three large volumes of the report to the National Civic Federation of its commission on public ownership and operation, entitled "Municipal and Private Operation of Public Utilities." These volumes can probably be obtained from the secretary of the Federation at 281 Fourth avenue, New York.

Wilcox's "Municipal Franchises," the first volume of which has appeared ($5), discusses the terms and conditions of franchises for private corporations operating public service utilities, the first volume being devoted to pipe and wire franchises, i. e., electric light, heat, and power, telephone, messenger and signal service, conduits, water works, sewers, central heating, refrigeration, pneumatic tubes, oil pipe lines, artificial and natural gas. It should be of much value in the study of the problem of ownership of such industries. It is reviewed in MUNICIPAL ENGINEERING, vol. xxxix, p. 231.

Brief chapters on the subject are given in Zueblin's "American Municipal Progress," ($1.25); Wilcox's "The American City," ($1.25); and Fairlie's "Municipal Administration," ($3).

It is difficult to select from the large number of articles in MUNICIPAL ENGINEERING those which are the most valuable. In vol. xxxviii, p. 347, will be found a list of the articles in vols. xxxvii and xxxviii, and on p. 324 of the former volume will be found a list of earlier articles. Later articles are as follows: In vol. xxxviii: "Factors That Should be Considered in Making Street Lighting Contracts," p. 393; "Relative Efficiency of Day Labor and Contract Systems of Doing Municipal Work," p. 408; "Valuation of Water Works System of Richmond, Ind.," p. 410; "Should City Contract for Electric Power," p. 416; Expediency of a Municipal Electric Light Plant," p. 416; Cost of Operating Arc Street Lighting Systems, p. 417; "Excessive Rates for Water and Electric Light, p. 417; "Day Labor vs. Contract Work on Los Angeles Aqueduct," p. 425.

In vol. xxxix: "Best Form of Water Works Franchise," p. 35; "Sewers on the Franchise Plan," p. 40; "Bill to Control Gas Companies in the District of Columbia, p. 51; "Municipal Abattoir and Reduction plant at Paris, Tex."; several brief news articles on pp. 129, 130, 131, 132, 133, 135; "The Municipal Electric Lighting Plant at Richmond, Ind.," p. 173; "Indebtedness for Public Service Plant May Not Be a Municipal Burden," p. 198; "Valuations of Public Service Corporations," p. 200; "Effect of Limitation of Indebtedness on Municipal Acquisition of Water Works," p. 219; "Determining Minimum Charge for Gas," p. 222; "Decree in Omaha Water Case," p. 300; "City Owned Car Line Pays," p. 302; "Maryland's Public Service Commission," p. 303; "The Municipal Lighting Works of Pasadena, Cal.," p. 311; "Some Modern Features of City Government and Legislation," p. 380; "Some Provisions in Modern Franchises for Municipal Service Utilities," p. 456; "Information About Franchises for Public Utility Corporations," p. 473.

In vol. xl: "State Regulation of a Massachusetts Telephone Company," p. 26; "Specifications for Electric Lighting Contract," p. 37; "Electric Light Franchise," p. 37; "Gas Processes and Rates," p. 38; "Influence of Indeterminate Franchises on

Sales of Bonds of Public Service Corporations," p. 46.

Many of these later articles are particularly valuable for the side-lights which they throw on the question.

Books on Foundations.

Will you kindly advise me the last date upon which Fowler's "Ordinary Foundations," and Patton's "Foundations" have been revised?

A. J. S., Winnipeg, Man.

The present edition of Fowler's "Ordinary Foundations" ($3.50) is the second revised and enlarged edition of 1907, and Patton's "Foundations" ($5) is also in its second edition, dated 1909.

Books on Reinforced Concrete.

In MUNICIPAL ENGINEERING, perhaps a year or more ago, in reply to a question concerning reinforced concrete work, you recommended to some one, a pocket book on the above named subject. I would like to get the book, and in description of same think it is 16 mo., contains 600 or 800 pages and priced $10.

L. G. M., Reno, Nev.

The book referred to is Mensch's "Reinforced Concrete Pocket Book" ($10). A review of it will be found on page 142 of the February number of MUNICIPAL ENGINEERING.

Edison Poured Concrete Houses.

El numero de Diciembre de la revista *American Comercial* de Philadelphia (The Philadelphia Commercial Museum) refiere copiandola de la Revista que del 14 al 20 Diciembre ultimo se celebra en Madison Square Garden una Exposicion de Productos de Cemento, en la cual habia expuesta alguna casa vaciada de Hormigon segun el plan de Mr. Edison.

Podria Vd. facilitarme datos para la construccion de dichas casas sistema Edison?

M. F., Barcelona, Spain.

Mr. Edison has for some years paid considerable attention to the exploitation of a method of making houses by pouring concrete into molds, put in place, apparently for the purpose of pouring the whole house at one operation. There has been much talk about the method in the newspapers, which has been renewed every time Mr. Edison claimed the overcoming of some practical difficulty. Thus far the only apparent advance which has been made is the demonstration that under certain circumstances concrete can be transferred from place to place through pipes. But the practical necessity for heavy cast iron molds, which cost much money and can be handled only by heavy machinery, has made the cost of the operation of casting a single house quite beyond reach.

Below is given one of the latest articles in the daily press on the subject. It should be noted that 144 houses per year of the same or practically the same design is scarcely a probability, from the standpoint of the land-owner building houses, unless in a new manufacturing town, such as Gary, Ind.; that this allows but two and one-half days for each house, which is a practical impossibility, when the time necessary to take down the molds from one house and put them up for another is considered, even neglecting the four days given as the time necessary to complete the house after the molds are up and the unstated time necessary for the setting of the concrete, which is delivered to the molds wet enough to flow readily to place; that the aggregates have a great tendency to separate from a concrete so wet as this; that the excess of water must be disposed of, and that a considerable portion of cement will escape with this water; that the molds must be water-tight, or the water and cement will escape where it is not wanted, and the process of stopping all the cracks between the sections of the castings must add materially to the time necessary to set up the molds. If further inconsistencies in the printed descriptions or further insurmountable difficulties, at least at reasonable cost, are asked for they can be pointed out.

Mr. Edison is very persistent and is not discouraged by difficulties in his way, but we must wait same time yet before he makes his $1,200 poured concrete house a practical commercial possibility, even for a large town made to order.

Following is the article referred to:

Mr. Edison announces that he has perfected his plan for molding a concrete house complete, "all in one solid piece, including the cellar, partitions, floors, roof, veranda, in fact, everything except the windows and doors, which are of wood and the only parts of the house which are combustible." Cement men say that the practical difficulties are insuperable, but Mr. Edison has a way of overcoming insuperable difficulties by "finding a way around" them.

The typical house would contain six rooms and a bath and would cost only $1,200, and would give a man for $10 a month a better home than he now rents for $25. The advantages would be exemption from fire risk and sanitary qualities, since should a case of contagious or infectious disease take place the walls would afford no harbor for germs and could readily be disinfected.

The disadvantages are that the house, which can be completed in four days, must be built in large numbers and on adjacent areas, since the cast iron molds are very heavy and must be handled by a derrick. The moving of the molds and derrick to any one locality would be a matter of considerable expense, which, if divided among fifteen or twenty houses, would amount to little. Besides, after taking down the molds an interval of four days must elapse before the walls set, during which time the workmen must erect others. For these reasons the house can not be cheaply constructed on a single vacant lot.

Mr. Edison's figures for building 144 houses a year are for each house:

Labor and superintendence	$ 150
Interest and depreciation on construction plant	140
Cement, 220 barrels, at $1.40	310
Steel reinforcement rods	125
Bath and heating	150
Windows, doors and finishing	325
Average a house	$1,200

These items are ample except that for bath, and the others are high enough to make the total a safe estimate. The house will be prettier and more comfortable than the wooden or brick house at twice the cost.

Aside from cheapness and durability, the great point is the elimination of the fire risk. Such a house would be good for five hundred years. Double the size of the house and the cost is not doubled, and the man earning $100 a month can easily own or rent a commodious home. Mr. Edison's estimates, however, are for Long Island and New Jersey, for he expects to use the sand removed in excavating the cellar to make his fluid concrete. Further, he must be near an ample supply of water.

Information About Concrete Silos.

The secretary of the Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, Pa., calls attention to Bulletin No. 21 of that association, which is devoted to "Concrete Silos" and should be added to the list of sources of information on that subject, given on p. 44 of the January number. The bulletin will doubtless be sent on request to anyone interested, on application to the secretary.

How to Make Poles for Wire Lines.

I should like to get a method of making dimensions, reinforcement used, etc., for concrete light and power poles. I shall greatly appreciate any information you or your readers may give me.

V. H. F., Kingfisher, Okla.

Will our readers report their experiences?

The following is a description by Wallace Marshall, of Lafayette, Ind., of a pole, designed by him as a test pole, and the changes which he would recommend:

In November, 1905, I made a box form of three sides, leaving the top open, for a test pole. It was 35 feet long. The lower 5 feet was 10 inches square; commencing at that point, it tapered on all sides to 5 inches at the top. From the 5-foot point I put a triangular piece in each corner of the form about 1½ inches wide at the bottom and 1 inch at the top, to chamfer the corners of the pole. At proper places of a standard line pole, for line bracket, cross-arms and telephone box, I bored holes through the forms, put machine bolts through it and let them extend about 2 inches in the forms, screwing the nuts the full length of thread. In the top of the form, which was brought to a round point, I placed a 1½-inch pin in the center to leave a hole or an insulator pin. I then filled the form with concrete mixed by hand, consisting of 1 part cement to 6 parts ordinary gravel, except a facing of about ½ inch of cement and sand, 1 to 3. After covering the bottom of the form about 1½ inches, I laid in the large end two ¾-inch Thacher concrete bars 25 feet long, and in the top part two ½-inch Thacher bars, lapping them about 4 feet. I left them in the form six days. At the expiration of thirty days we tested it as follows: We planted it firmly in the ground 5 feet deep. At 25 feet distance we planted a large cedar telephone pole. At the level of 21 feet from the ground we fastened a wire cable from one pole to the other, which is about the height of a trolley wire. In the center of this cable we suspended a barrel. Into this barrel we loaded steel rivets gradually and watched results. The two poles began to bend as the load was applied. When the two were deflected about 21 inches each toward the other I observed a small check come in the concrete pole about 10 feet from the ground, and simultaneously they appeared from the cable to the ground. We immediately stopped loading, took off the ballast, weighed it and calculated the horizontal strain, and found it to be 975 pounds. The maximum moment would be at the ground, but the guess at size we made was about right, since the concrete cracked from ground to cable at almost the same time. When the load was removed the pole resumed its plumb position, and remains so to-day, although being used for heavy guy wires. The bolts were unscrewed before moving them, leaving the nuts imbedded in the pole. After concrete set we screwed the bolts into the nuts and could not loosen them with an ordinary wrench. It took several heavy blows with a sledgehammer to break out the top socket. My conclusions were, however, that a wire ring or two of reinforcement should be placed about the pin for safety. Careful estimates were made as to cost of such a pole 35 feet long, if made in quantities in proper forms, with material at the then market price and gravel in pit, at $7 actual cost. Comparing that cost with present price of pine poles and add to the latter the cost of trimming, chamfering, framing and painting, the concrete pole can be made for less money than the wood, provided no profit is paid a contractor. Figuring the moments on the pole tested, I found the concrete failed at just about the time the limit of elasticity of the steel was reached, proving that it would be of no value without the steel. I believe that the concrete pole is practicable, and the only reason I have not put them to a practicable use has been the lack of time to do so.

In the fall of 1906 one of the western lines of the Pennsylvania railroad erected a mile of concrete poles on their right of way near Maples, Ind., in order to test them out in actual service. They were built by Mr. Herman Tapp, and were hauled out on cars to the point of erection. The profile of the ground being somewhat uneven, the lengths of the poles were varied from 25 to 34 feet, in order to keep the tops of the poles as nearly as possible on a continuous grade. The poles were 8 inches square at the bottom and were tapered to a 6-inch square at the top, the corners being chamfered 2 inches, making the pole appear octagonal above the ground.

Holes were left for the brace and cross-arm bolts and also for the steps. The reinforcement consisted of twenty-four ¼-inch wires running the full length of the pole. The conditions under which the poles were erected were not of the best, as the work was rushed in order to have the pole line complete for the date of a certain inspection trip. Because of this fact some of the poles were moved from the point of building and were erected within five days after they had been made. Notwithstanding this hurried method of construction and the severity of the wind-

storms of the past winter, the poles show up at present in almost perfect condition. The alignment is of the best and the condition of the individual poles is very good, as no check marks or other signs of failure have appeared. The poles were set 4 feet under the ground and were bedded in stone screenings, giving a solid foundation.

There are several patented poles on the market.

Those traveling to New York from points west to visit the cement show, December 14 to 20, were interested in observing a new reinforced concrete pole line built by the Pennsylvania railroad on the left of their new right of way going into New York City. This pole line is for the purpose of carrying sixty telegraph and telephone wires, the poles varying in length from 35 feet to 65 feet. They were designed and built by the Pennsylvania railroad, and are a striking example of this comparatively new use of concrete.

Small Concrete Arch vs. Girder.

I want to ask if you can tell me where I can find anything about small concrete arches, span about 12 feet, to be artistic. It has occurred to me that it would be cheaper built as a girder with a curtain arch at either end. I think this possible because it is not visible from below at any place, and the cost ought to be less.
READER, Denver, Colo.

Tyrrell's "Concrete Bridges and Culverts" ($3) gives the discussion desired. The general conclusions are that a simple slab is economical up to 12 feet span; slabs supported on longitudinal beams are probably the most economical between 12 and 25 feet span, and arches are probably most economical for spans above 35 feet. These statements will be modified by conditions of foundation, abutments, etc. Probably, with the curtain arches spoken of, the two forms will be nearly the same cost. Usually on bridges of small size the ornamental work is a large share of the cost, if it is of any real value, and can not be estimated without detailed plans.

Consumption of Water by Cities.

Will you kindly refer us to some of your monthly numbers containing data as to how much water is used per capita in different cities.
W. A. HENSON,
Vicksburg, Miss.

In vol. xxxvii, pp. 258 and 330, will be found some "Valuable Data Regarding Water Supplies," in cities of 25,000 to 50,000 population. Included therein are statements of the daily consumption of water by the cities, from which, with estimates of the population in the year 1908, the consumption per capita can be computed. In vol. xxx, p. 18, is an article on "Consumption of Water in Small Cities," giving figures for cities of 2,000 to 5,000 population.

Turneaure and Russell's "Public Water Supplies" ($5) gives the consumption of water per capita in a number of cities for the year 1905.

The consumption in the city of Chicago for the past year has varied but little either way from 204 gallons per capita per day.

Companies Operating Several Water Plants.

We would like to ask you for some information about water works companies. In our town here of about five thousand inhabitants there is a water works company doing business, but their franchise expired some five years ago, and there is some agitation on foot at the present time looking toward granting this same company a franchise, or some other company one, apparently with the odds in favor of another company. If possible, it is the intention to submit the franchise at the spring election.

What we would like to know is the names of some companies that make it a business to install and maintain water works, in order that we may take the matter up with them and see if anything can be done with them. If you can give us the names and addresses of several of these concerns we will be greatly obliged to you, and shall be glad at any time to give you any information possible from here.
C., ———, Mo.

The writer knows of no company which answers the description exactly. The American Water Works and Guarantee Co., Bank of Savings building, Pittsburg, Pa., own a large number of water works plants, but whether they would be willing to invest in another small plant under the circumstances described is questionable. There are other large investors in water works plants not so thoroughly organized as the company named, who own companies operating under local names. Names of any such persons will be referred to our correspondent of they are sent us for that purpose.

The writer does not believe that the course outlined is the proper one to pursue. He has found that water companies are perfectly willing to accept franchises based upon equitable terms and the only question is as to the method of determining what such terms shall be. This is a question for experts and a proper solution is worth all it costs.

There is no such thing as real competition in the supply of water, especially for so small a city, and the consumers must ultimately pay the extra cost of unwise duplication of plants. Such a commission as that outlined in the articles in MUNICIPAL ENGINEERING in vol. xxxviii, p. 335, on "Co-Operative Franchises for Municipal Public Service Corporations"; vol. xxxvi, p. 247, on "An Outline of a Contract Between a City and a Water Works Company," and vol. xxxix, p. 456, on "Some Provisions in Modern Franchises for Municipal Service Utilities," should secure the desired results, on the one hand of good service at reasonable rates, and on the other hand of ample provision for depreciation and renewal and reasonable return upon the capital invested in the works.

Life of Bolts in Machined Cast Iron Pipe Joints.

We have been using some "Universal" cast iron water pipe and have had no trouble on account of bolts rusting on pipe that has been in the ground three years, but are not certain that bolts will last indefinitely. Please give what information you can about the useful life of bolts used for connecting machined joints of cast iron water pipe, as compared with the life of the pipe. Information about results of using bolts for "Hammond" or "Dresser" joints on underground pipe lines will serve just as well.

W. O. M., Ottawa, Kans.

Will our readers give their experience for the benefit of our correspondent and other readers?

Some information in this line will be found in papers on wooden stave pipe by A. L. Adams in the transactions of the American Society of Civil Engineers, vol. xxxvi, p. 1; vol. xli, p. 27, and vol lviii, p. 65. This information is not exact; as regards the bands, used for holding the staves together, and the nuts used in tightening them, they could be and were used again in repairs made in 1905 on pipe laid in 1895. Another pipe laid in Manchester, N. H., in 1874, was reported as needing no repairs in 1899. In correcting some trouble in the piping system of the hot-water heating plant in Mattoon, Ill., both pipes and bolts were found to be practically useless after three years. The circumstances are, of course, different from those in a water supply, both as to temperatures and the presence of insulating materials.

Electrolysis of Water Mains.

We have electrolysis in our water mains here caused, evidently, by improper equipment of the electric railway. They are using an ordinary 60-pound T-rail on our paved streets, while the city ordinance calls for Shanghai rails. We have had water meters completely destroyed and several service pipes so badly damaged that they have had to be replaced. We have tried to get our city council to take some action towards forcing the railway company to relieve this situation, but they evidently do not see the seriousness of it. What do you consider the situation? Would it warrant a law suit to compel these people to change their equipment? Do you consider electrolysis in water mains an extreme bad condition? We are trying to get together information on this particular condition and would appreciate an early reply from you.

A. E. W., ———, Mich.

This matter of electrolysis of water and gas mains by stray currents in the earth is one which is in some cases very serious. It is one which has a number of legal and economic phases aside from the actual damage done to the pipes. That this damage can be serious and expensive has been demonstrated many times, and that it is due to insufficient conductors for the return currents of the electric railway system is equally certain. Much of the trouble can be prevented by proper bonding of the rails. There may also be trouble on account of insufficient size of rails. The damage occurs at the points where the current, having run along the pipes, leaves them to go to another conductor, through an intervening medium of less conductivity. The difference of potential, showing the strength of this tendency, can be ascertained by measurement, and will show the extent of the danger and give some indication of where the changes must be made to prevent damage.

The question of responsibility for the damage is one which has been under discussion for some years. The case of the Peoria Water Co. against the Peoria Gas and Electric Co. has been in court for a dozen years, and many other cases and prospective suits have been awaiting the decision in this case. The reports of the special master appointed by the court to collect evidence in the case were made in 1901, reported in MUNICIPAL ENGINEERING, vol. xxi, p. 34, and in 1909, reported in vol. xxxvii, p. 174. These were both very favorable to the water company. The preliminary decision of the court, made in 1910, differed quite materially from the master's reports. It is reported in vol. xxxix, p. 465. It recognizes the fact that both street railway and water company have rights in the streets which must be respected, and recommend cooperation of the two in eliminating the danger. Apparently the expense is to be distributed, but the basis of the distribution is not stated. Probably it will appear in the final order when it is made.

The nature of suits and the decisions regarding them in other cities were reported in MUNICIPAL ENGINEERING as follows: Dayton, O., vol. xxii, pp. 299 and 322; vol. xxi, p. 38; St. Paul, Minn., vol. xxii, p. 317; St. Louis, Mo., vol. xxi, p. 101; Indianapolis, Ind., vol. xx, p. 47.

Other interesting articles are the following: "British Legislation Relative to Electrolysis, vol. xxxix, p. 220. "Electrolysis of Underground Structures in American Cities," giving the conditions and what has been done to correct bad conditions in 113 cities, vol. xxxix, p. 206. "Electrolysis and Prevention of Its Effects," vol. xxxvii, p. 107. "Books on Electrolysis," vol. xxxvi, p. 244. "Electrolysis in Reinforced Concrete," vol. xxxiii, pp. 111, 183. A long list of prior articles on electrolysis, covering the period of most active discussion of the question, will be found in vol. xxxii, p. 19. See also the article in this number giving information about several cities.

It would seem that a municipally owned water plant would be in somewhat different position, with respect to the responsibility of the street railway company, since the city has granted the right of way for the street railway and presumably has the right to insist that its property shall not be damaged by the construction and operation of the railway. It is quite probable that the street railway franchise contains such a clause, covering the case in general

terms, though not specifically mentioning electrolysis.

The course proper for the city would seem to be to determine first the cause and amount of the damage, preferably with the co-operation of the street railway company, and the rights of the city under the existing legal and franchise conditions, and then to make or force a settlement as may seem most desirable and feasible.

Location of Water Pipe in Street.

Please accept my thanks for the answer to my question on p. 119 of the February number of MUNICIPAL ENGINEERING. The situation of the water pipes on the Concourse should be explained to you more clearly. The Concourse is an avenue of 150 feet or more in width and consists of two outside strips for general traffic and a center strip for light roadsters. The water main goes down the roadway. It is proposed to install two service pipes, one on each side of the Concourse, and it is regarding these service pipes that the contractor makes the request to be allowed to put them in the roadway. We take the view that they should be under the sidewalk.

CYRUS C. MILLER,
President of the Borough of the Bronx.

The writer would, in this case, strongly recommend the location of the two service pipes for each side of the street for each block within the space set apart for the sidewalk and lawn. The service pipes should be preferably taken off the mains in the cross streets at the ends of the blocks, and may be connected to such branch mains at each end if the conditions warrant. Thus they can be kept down to minimum size and give each house full pressure, even if the distance between cross streets should be much greater than is usual. Whether these two service pipes should be located under the sidewalks or lawn must be decided from knowledge of the particular conditions of the case, and in consideration of the principles discussed in the article referred to.

Wood Block Paving and Street Railway.

We intend to pave one of our main streets next spring with creosoted wood block. Width of street between curbs is 41 feet. The street railway company contemplates putting down a double track on same. Their tracks will take up 17 feet, leaving 12 feet on each side between the ties and curb. What kind of rail, in your judgment, would be the best to use, the girder or T-rail? What style of rail is used in Indianapolis? The T-rail is used here at present, but we find that it causes trouble to vehicles in crossing.

What slope should there be between the track and curb? The grade of the street is 1 per cent. W., ———, Wis.

The question of the form of rail to use is one on which there is much difference of opinion. Both girder and T-rails are used in Indianapolis, and they seem to give about equal satisfaction. The space between tracks and for 18 inches outside is paved with brick, and special forms of brick are used next to T-rails on the inside to give the space for the flanges on the car wheels, which are somewhat deeper for interurban cars than for city cars. The T-rail lines are laid for the use of the interurban cars. There seems to be little or no more difficulty in crossing the groove made by the special-formed brick than the groove formed by the girder rail, whether the top of that rail is flat or grooved. The form of rail is really not of very great importance if the design of the pavement surface next to the rail is made to conform to the conditions fixed by the form of the rail.

The important things with reference to the rails and tracks are solid foundation under ties and rails and depth enough of rail to insure stiffness and stability. A 7-inch rail seems to be an essential to good pavements and a 9-inch rail is desirable if heavy interurban cars are carried.

The slope across the pavement from rail to curb should be as slight as possible on a 1 per cent. longitudinal grade. The rules in vogue in various cities vary from 2⅞ to 7¼ inches for the 12 feet between track space and curb. The minimum should be sufficient in this case. The center of the tracks should be enough higher than the line between the street railway and street pavements to give the track space as good drainage as possible. The groove will interfere with this drainage somewhat, and they should be water-tight, so that the water will not get down under the pavement along the rail.

History of Los Angeles Water Supply.

Will you indly advise us where we can procure a brief history of the Los Angeles Water Works Project and very greatly oblige.

H. MUELLER MFG. CO.,
Decatur, Ill.

The Los Angeles water works have been treated in the following recent articles in MUNICIPAL ENGINEERING: "Day Labor vs. Contract Work on Los Angeles Aqueduct," vol. xxxviii, p. 425; "The Los Angeles Aqueduct," vol. xxxvii, p. 289. It has also in preparation for early publication an article giving the history of the water supply of the city prior to the development of the new system.

Best Pavement for Steep Grade.

What, in your opinion, is the best material for a street improvement from a safety point of view, with a grade of 10 per cent?

What is your opinion of bituminous macadam pavement for a grade of this kind? Do you think it would have a tendency to wash? W., ———, O.

This question cannot be answered definitely without full knowledge of all the local conditions. For heavy traffic a stone pavement is probably safest. On some of the country roads outside of Cleveland a brick with one edge beveled is being used. This bevel gives a chance for the calbs of the horses' shoes to catch on the edge of the brick next below or the cement

of the joint and thus give him foothold in climbing the hill and prevent sliding in going down hill. These roads promise well, but have not been in use long enough to show whether they are better than roads laid with ordinary forms of brick. Brick pavements as ordinarily laid are as satisfactory as any on such steep grades. It is difficult, if not impossible, to haul heavy loads up such grades unless there are projections or depressions with which the shoes of the horses can engage.

For light weight traffic other kinds of paving material can be used, provided the surface retains a somewhat roughened appearance and does not wear so smooth as to become slippery. The writer has seen horses trot up and down a 7 per cent. grade on a wet bitulithic street without any fear of slipping. There was every indication that if the grade had been 10 per cent. they could have traveled with equal ease, except that the steeper gradient would reduce the speed of pulling up the hill. Bituminous macadam is an indefinite terms which covers many ways of building streets. If there is an excess of bituminous material at or near the surface the pavement will probably become slippery when the surface dressing of stone chips has worn off. Some pavements are laid with bitumens so soft that they work to the surface and produce slipperiness under common conditions of temperature and moisture. A bituminous macadam pavement with proper proportions of stone, bituminous cement and sand or stone dust, should be satisfactory on the steep grade named, and if the materials are as good as they should be and are properly mixed and laid, the road should retain its non-slippery quality. Under such conditions it will not wash unless it is permitted to get badly out of repair.

Formula for Asphalt Floor.

I have a building in charge specifying asphalt floors on top of concrete, the asphalt floor to be one inch thick, warranted not to crack or run in warm weather. As I have never put down an asphalt floor I wish you would give me a formula for such floor, as to the amount of pitch, flux and sand that is required, portions of building to be at a temperature 28 to 32 and 34 to 38 degrees Fahrenheit.

L. M., Evansville, Ind.

Will our readers engaged in asphalt construction give their experience in this line?

Such firms as the Sicilian Asphalt Paving Co., 41 Park Row, New York, supply asphaltic mastic ready to lay, to fit any floor specification. All that is necessary is to heat it, put it in place and compact it. The proportions of any mixture for a floor depend upon the quality of the asphalt. The dealers in the various kinds of asphalt will give the formulas directly applicable to their products. Names of such dealers will be found in the "Business Directory," published in each number of MUNICIPAL ENGINEERING, under the various headings containing the word "Asphalt."

It should be noted that an asphalt floor probably requires asphalt to be used and that pitch is a term frequently applied to certain tar products which might be excluded by the terms of the specifications.

Chemical Clarification of Water.

I wish you would kindly give the names of the cities in the Central States who use sugar sulphate, etc., to clarify water. We mean water departments of the different cities.

S., St. Louis, Mo.

The writer knows of no city using sugar sulphate to clarify water, and indeed, knows of no such substance. The usual substances used for clarifying, softening and sterilizing water are lime, soda ash, sulphate of iron, sulphate of alumina, hypochlorite of lime, hypochlorite of soda, sulphate of alumina being the one most commonly used for clarifying water, as it fits the chemical condition of nearly all waters requiring clarification. Nearly all mechanical filter plants use it, alone or in combination with one or more of the others named.

Cities Owning Their Asphalt Paving Plants.

Have you a list of the towns in the United States owning their own asphalt paving plants which you could furnish us?

A., Chicago, Ill.

Following are the cities owning their own asphalt plants, many of them being used for repairing asphalt pavements only, but some being used for both repairs and new construction: San Francisco, Cal.; Denver, Col.; Bluffton and Indianapolis, Ind., and Marion, Ind., a small portable repair plant; New Orleans, La.; Detroit, Mich.; Kansas City, Mo.; Brooklyn, N. Y.; Cincinnati, Columbus and Dayton, O.; Pittsburg and Allegheny, Pa., with one ordered for Erie, Pa.; Nashville, Tenn., for bitulithic, and Chattanooga, Tenn., a small portable repair plant; Houston, Tex.; Seattle and Spokane, Wash.; Milwaukee, Wis. There are also plants at Winnipeg, Man., and Hamilton and Toronto, Ont.

Cost of Street Paving.

If it lies within your knowledge, please inform me about how much per square yard of completed work other cities or townships are paying for macadam, asphalt, brick, stone, granite and wood block paving.

A. M. A., Oregon, Ill.

Prices vary so much according to local conditions and specifications that definite figures cannot be given in answer to so general a question. In MUNICIPAL ENGINEERING, vol. xxxvii, p. 177, will be found a collection of current prices for the various kinds of pavements, made from the prices quoted in the monthly numbers of

this magazine. They range as follows, per square yard:

Macadam, 50 cents to $2.13;
Asphalt, $1.45 to $3.24;
Brick, $1.21 to $3.63;
Sandstone block, $3.10;
Granite block, $3 to $3.96;
Wood block, $1.75 to $3.72.

In the same number, on page 152, will be found a collection of prices paid for pavements, made by a committee of the Illinois Society of Engineers and Surveyors. According to this collection, which covers much of the United States, Illinois prices for pavements were about as follows, per square yard:

Macadam, 12 inches thick, 98 cents; 9 inches thick, $1.28; 8 inches thick, 40 cents. Material differences in specifications are evident from the variations in prices.

Asphalt, $2.03 to $2.10.

Brick, $1.40 to $2.55, the latter being a Chicago price which is nearly 50 cents above the maximum price outside the city.

Granite block, $2.77 to $3.89.

Wood block, $2.60 to $3.49.

Sandstone block cost in Michigan $3.85.

Similar figures for 1910 can be gathered from the monthly numbers of MUNICIPAL ENGINEERING, in vols. xxxviii and xxxix, by consulting the department of "Improvement and Contracting News," under "Paving," "Contracts Awarded."

Flushing Street Sewers.

We are very desirous of getting a copy of your journal, in which was published an article on the flushing of street sewers, by Mr. Andrew Rosewater. We do not know the exact date of this article, but of you have on hand a spare copy of the issue in which it was contained, we would appreciate having you send us this at once, and will remit immediately.

E. B. B., Camden, N. J.

No article by Mr. Rosewater on flushing street sewers has been published. Some data derived from experiments made by Mr. Rosewater have, however, been published in MUNICIPAL ENGINEERING, as follows:

Vol. xi: "Automatic Flush Tanks on Sewers," p. 34, giving data as to waste of water by flush tanks in Omaha, Neb.

Vol. xii: "Velocity of Discharge of Automatic Flush Tanks," p. 92, giving data as to effect of discharge from flush tank.

Vol. xiii: A review of Adams' "Sewer Flushing Diagrams," p. 170, compares the data given on the diagrams with those obtained by Mr. Rosewater.

Vol. xiv: "A Point on the Design of Flush Tanks," p. 217, an editorial giving a table of data as to capacities of tanks, gradients of sewers, velocities of discharge of tanks and of flow in sewers as observed for 8 and 10-inch pipes, derived from the manuscript record of Mr. Rosewater's experiments.

Other articles giving data on the subject, some not obtainable elsewhere are the following:

Vol. xi: "Waste of Water by Automatic Flush Tanks," p. 102, an editorial containing estimates of maximum and minimum discharge of flush tanks per day.

Vol. xiv: "Sewer Flushing," p. 190, an editorial giving brief statement of methods and apparatus for sewer flushing other than flush tanks; "Efficiency of Flushing Sewers with Flush Tanks," p. 208, giving some data procured by Prof. A. N. Talbot; "Some Sewer Flushing Experiments," p. 285, giving results of experiments made by Prof. H. N. Ogden.

Vol. xvi: "Flushing Devices for Small Sewers," p. 24, giving data and diagrams and tables based thereon, which were derived from experiments made in Washington, D. C., by Asa E. Phillips.

Vol. xvii: "Flush Tanks and Water Waste," p. 305. An editorial giving data from Newport, Ky.

Vol. xviii: "Use of Large Flush Tanks for Cleaning Outlet Sewers," p. 310, collecting a few data on this phase of the subject.

Vol. xix, pp. 23, 93 and 412, brief articles giving some further information.

Vol. xx, pp. 24 and 165, two articles giving further information on flushing large sewers and on frequency of discharge of flush tanks, the latter giving data from Highland Park, Ill.

Vol. xxxiv: "Special Designs for Flush Tanks," p. 368, giving forms used in Great Falls, Mont.

Vol. xxxix: "A New Sewer Cleaning Device," p. 237, with a description of a test in vol. xi, p. 69.

Information About Flow of Sewage.

What is a fair estimate of flow of sewage in a sanitary sewer system, stated in gallons per capita per diem? First, where water is sold by meter? Second, where water is not metered?

Is there any record of storm sewers having been destroyed by excessive scouring action due to steep grades?

What is regarded as the minimum grade (feet per hundred) for 6, 8 and 10-inch sewers without flush tanks?

C. E., Okla.

The estimates for flow of sewage vary somewhat according to the size of the city, the use of water apparently increasing more rapidly than the population. The local conditions must be studied carefully and possible changes in conditions must be considered. It is common to assume 100 gallons per capita per day as the flow of sewage for a small city, when there is not enough information on which to base a more careful estimate. If water is metered the meter records give the amount used. It is probably 25 to 35 per cent. less than if not metered.

Sewers on steep grades are not infrequently badly worn and sometimes the bottoms are scoured away completely. Omaha, Neb., has had some sewers in this

condition, and doubtless all cities on side hills or bluffs can report similar troubles. Paving brick are recommended sometimes for inverts of sewers under such conditions. Concrete sewers have have been designed with paving brick inverts to resist such wear.

The minimum gradient for sewers running half-full may be assumed as 0.4 foot per hundred for 6-inch pipe, 0.25 for 8-inch and 0.2 for 10-inch. These gradients give fair velocities, though not self-cleansiing under all conditions. If there are no flush tanks and the separate system is used, large parts of the small branches, 8-inch for street lines and 4 and 6-inch for house and larger building connections, will never run half-full, and the self-cleansing velocity will never be attained. On steep gradients, say 4 or 5 feet per hundred, the water may run away from the solids carried and thus produce deposits, not ordinarily troublesome to any appreciable extent. It is doubtful if the upper ends of branch sewers can ever be kept entirely clean without occasional flushing with tanks or hose. The lower end of such a line a half-mile or more long will probably keep itself clean if laid on gradients say 50 per cent. greater than the minima quoted.

Patents on the Septic Tank.

I would like to know whether or not the courts have upheld the Cameron patents on septic action.

W. W. S., Choctah, Okla.

An extract from a circular of the Cameron Septic Tank Co., giving their statement of the decision in their favor of the Saratoga Springs case will be found in the September number of MUNICIPAL ENGINEERING, vol. xxxix, p. 238. Later articles giving information and opinions on the subject will be found in vol. xxxix, p. 439, "The Present Use of the Septic Tank"; p. 390, giving references to many earlier articles on the use of the septic tank and the patents thereon; vol. xl, p. 1, "Sewage Disposal Plans of Atlanta, Ga.," containing a statement of the position of the company regarding the Imhoff tanks.

Storage Batteries for Individual Lighting Plants.

Will you kindly refer me to some book wherein I can post myself on storage batteries for furnishing light?

We would like to install a gasoline engine at our farm and with it pump water, furnish light, and do other work needed about the place.

C. C. H., Eureka, Kan.

Foster's "Electrical Engineers' Pocket Book" ($5) has 30 pages of fine type concerning storage batteries, which give some good information on the particular problem stated. "The Theory of the Lead Accumulator" ($2.50) is a translation of a German book by Dr. Dolezalek on the storage battery. Elementary treatises on the storage battery are Marshall's "Small Accumulators" (50 cents) and Niblett's "Portative Electricity" ($1). Lyndon's "Storage Battery Engineering" ($3), Wade's "Secondary Batteries" ($4), Treadwell's "The Storage Battery ($1.75), are the more recent books on the subject.

Rates for Ornamental Street Lighting.

We are designing a new system of street lighting for the business section of our city, and in order to present the subject properly to our city council it is necessary to have the cost of similar systems in other cities.

The proposed system consists of iron lamp posts or standards, placed every 100 feet along both sides of the street, and directly opposite. At the street corners the standards support a cluster of five tungsten lamps, and between the corners a cluster of three lamps. Each lamp consists of a globe of diffusing glass, with a single 60-watt tungsten lamp in the center.

Our electricity is furnished by a private company, and they have agreed to furnish the electricity as cheap as any other city is getting it under the same circumstances.

If you can give us any information as to the cost per lamp, or post, or rate per k. w. for the electricity as paid by other cities for similar systems it will be greatly appreciated. We are more particularly interested in the rate per k. w. If this cannot be furnished, possibly you can give us the names of a number of cities that have such a system, so we can write them. A. J. M., Webb City, Mo.

In the January number of MUNICIPAL ENGINEERING, vol. xl, p. 37, will be found a list of articles on electric lighting contracts which should aid in the solution of the problem stated. In particular: The article in vol. xxxix, p. 50, gives the Indianapolis contract between lighting company and business men, whereby the price is set at $1.05 per front foot of property or store per year. For the layout of lamps, hours of lighting provided for and kind of lamps used, this apparently figures out about 1.8 cents per k. w. hr. The articles in vol. xxxviii, on "The Tungsten Lamp and Its Relations to Central Stations" on p. 166, on "Central Stations for Towns of 1,000 Population," on p. 169, give some valuable information directly applicable to this case, and that on "Rate for Tungsten Street Lamps" on p. 330 will also be of interest, as the minimum rates there given are about the same per lamp per year, $14, as the cost of the nIdianapolis light when reduced to the same basis.

Reference may be made also to the recent articles on ornamental street lighting in vol. xxxix, p. 416, p. 132, giving list of cities adopting the plan, and elsewhere in this number, giving details of the new Cincinnati plan for ornamental lighting and the progress in a number of other cities. The Cincinnati ornamental lights give three times the illumination for the same current, using the same meter rate as for former standard street lighting.

Gas Processes and Rates.

(Continued from page 125.)

City and Process.	Coal cost per ton.	Oil cost per gal.	Prices for Gas. Light. Gross.	Light. Net.	Fuel. Gross.	Fuel. Net.
MISSISSIPPI.						
Hattiesburg, coal	....	....	1.50	1.40	....	....
MISSOURI.						
Brookfield, Lowe	....	....	1.60	1.50	1.35	1.25
Cape Girardeau, coal	....	....	1.00	....	....	....
Chillicothe, Patton, oil	....	....	1.40	1.00	1.40	1.00
Clinton, coal	3.05	....	....	1.80	....	1.50
Columbia, coal	....	....	2.00	1.75	2.00	1.75
Excelsior Springs, Lowe	10.00‡	2.5	....	2.00	....	1.50
Lexington, coal	2.62	to 6	1.50	1.25	1.50	1.25
Louisiana, coal	4.35	....	....	1.25	....	1.25
Macon, Patton, oil	2.50	4.5	2.50	1.90	2.50	1.25
Marshall, coal	....	....	1.50	1.35	1.50	1.35
Mexico, Lowe	....	....	1.50	1.25	1.50	1.25
Nevada, coal	....	....	2.00	1.50	2.00	1.50
Trenton, Moses-Lowe	....	....	1.50	1.425	1.50	1.425
NEBRASKA.						
Fairbury, Tenney	7.25‡	3.4	1.50	1.42	1.50	1.42
Kearney, Lowe and Tenney	7.00	4.125	1.75	1.575	1.75	1.575
Nebraska City, coal	5.50	....	1.60	1.50	1.60	1.50
Norfolk, Tenney and Springer	....	....	1.70	1.60	1.70	1.60
Plattsmouth, Lowe	6.35‡	3	1.75	1.50	1.75	1.50
York, practical, water	7.50	4	1.80	1.62	1.80	1.62
NEW HAMPSHIRE.						
Claremont, Lowe	....	....	1.80	1.60	1.80	1.60
Exeter, coal	5.00	....	2.10	2.00	2.10	1.50
Franklin Falls, oil	....	....	5.00	....	....	....
Laconia, Lowe	....	3.4	2.00	1.80	2.00	1.80
Portsmouth, coal	3.95	....	1.50	1.35	1.50	1.35
Somersworth, Kendall, oil	....	....	....	2.00	....	1.50
NEW JERSEY.						
Hammonton, Logan-Janeway, water	....	....	1.50	....	1.35	....
Keyport, coal	3.85	....	2.00	1.75	2.00	1.75
Lambertville, coal	3.50	....	2.00	1.50	1.75	1.50
Newton, coal and Lowe	**	4.375	1.75	1.60	1.35	1.20
Princeton, coal	....	....	1.80	1.60	....	....
Ridgewood Junction, W. G. C. Co	....	....	....	1.15	....	....
Salem, coal	3.35	....	1.60	1.36	1.60	1.36
South Amboy, coal	....	....	1.60	1.50	1.60	1.50
NEW YORK.						
Albion, coal	3.00	....	1.50	1.25	1.50	1.25
Bath, coal	....	....	....	1.50	....	1.50
Brockport, coal	3.15	....	1.60	1.50	1.60	1.50
Canandaigua, coal	3.80	....	....	1.50	....	1.25
Catskill, coal	....	....	2.00	1.50	2.00	1.25
Dansville, Lowe	5.00	3.5	1.75	1.65	1.75	1.45
Fredonia, coal	....	....	1.75	1.50	1.25	1.00
Fulton, coal and Lowe	3.07	3.25	1.35	1.25	1.35	1.25
Glen Cove, Lowe	....	....	....	1.50	....	....
Haverstraw, Boecklin	....	3.5	1.50	1.50	1.50	1.50
Hoosick Falls, coal	4.07	....	1.60	1.50	1.60	1.50
Hudson, coal	3.90	....	1.75	1.60	1.50	1.35
Huntington, Lowe and Sutherland	5.50	4.8	2.20	2.00	1.60	1.50
Lyons, coal	3.29	....	1.80	1.40	....	....
Malone, coal	4.00	....	2.00	2.00	1.50	1.50
Mechanicsville, Lowe	5.00	3.5	2.00	1.50	2.00	1.50
Medina, coal	3.20	....	....	1.75	....	1.25
Newark, coal	3.14	....	1.60	1.40	1.60	1.40
Norwich, Lowe	5.25	3.45	1.80	1.30	1.80	1.00
Nyack, Lowe	....	....	1.60	1.50	1.60	1.50
Ogdensburg, coal	....	....	2.25	1.90	2.00	1.50
Oneida, coal and Lowe	....	....	....	1.75	....	1.50
Oneonta, Lowe	4.75	3.75	1.50	1.50	1.50	1.50
Owego, coal	3.21	....	1.80	1.40	1.80	1.40
Patchogue, Lowe	....	....	1.50	1.50	1.50	1.50
Penn Yan, coal	4.50	....	1.80	1.60	1.80	1.40
Port Jervis, Lowe	....	....	....	2.00	....	1.50
Saugerties, coal	4.20	....	2.00	1.90	2.00	1.60
NORTH CAROLINA.						
Fayetteville, coal	....	....	....	2.00	....	1.50
Washington, Lowe	4.55	4	1.60	1.50	1.35	1.25
NORTH DAKOTA.						
Jamestown, oil	....	....	2.00	1.80	1.65	1.45
OHIO.						
Bucyrus, Lowe	....	....	1.80	1.50	1.80	1.35
Defiance, coal	2.95	....	1.40	1.30	1.40	1.10
Greenville, coal	3.00	....	1.50	1.40	1.50	1.30
Hillsboro, coal	2.25	....	1.50	....	1.35	1.00

**Anthracite, $6.25; bituminous, $4.15.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Electrolysis of Underground Structures in American Cities.

The following information regarding electrolysis in pipe systems of water works plant may be added to that given in vol. xxxix, p. 206, regarding 113 cities in the United States:

Alameda, Cal.: Tests are made every 4 to 6 months; rail bonding has been improved and return circuit improved by bonding rails to mains in some places; no recent trouble has been observed.

Berkeley, Cal.: Similar conditions. Same water and electric companies.

Oakland, Cal.: Similar conditions. Same water and electric companies.

Sacramento, Cal.: No tests made; bonding good; mains and rails connected in a few places and return metallic circuits from rails to power house; no recent trouble from electrolysis.

San Francisco, Cal.: Systematic survey of electric conditions made by water company, and arrangements for observation of conditions, on one street; maximum difference in voltage is 5 between pipe and rail there and a flow of 100 to 200 amperes along the pipe; no tests made by city; street railway company is rebuilding lines and using heavy, well-bonded rail; water mains are bonded to the returns to the street railway power house at present; serious results from electrolysis, especially on wrought-iron water pipe; considerable length of large wrought-iron pipe damaged or almost destroyed on Harrison street near Eleventh, and Eddy near Devisadro, and cast-iron pipe destroyed at Bryant and Seventeenth streets; conditions improving; conduit companies report no trouble from electrolysis.

San Jose, Cal.: No recent surveys, telephone company reports reading as high as 75 volts on its underground cables; rail bonding poor; return circuits not well taken care of; electrolysis considerable, e. g., 2 miles of 5-inch pipe and many house connections destroyed; formerly three railway systems, now two consolidated, interurban power house moved out of city, all have improved conditions; also relaying and properly bonding of one system is helping; rails and mains are connected in several places and house services are used for grounding; gas company reports considerable trouble from electrolysis which is still showing occasionally.

Colorado Springs, Col.: No surveys; telephone company makes annual tests, no recent damage; street railway company made test of bonds in 1909, replacing broken ones; water mains bonded to rails at one palce; on one line 12 feet of 8-inch pipe destroyed within last two years, with considerable current running in mains; many house services have been destroyed.

Waterbury, Conn.: Telephone and street railway companies make regular tests; no apparent electrolytic action and no damage reported by water works.

Fort Wayne, Ind.: Telephone companies make regular investigations, bond their cables together and to street railway rails; damage at one point caused improvement of rail bonding there; rails are return circuit; no recent damage to water mains, sometimes shows on house service pipes.

Butte, Mont.: Electrolysis survey made 13 years ago, street railway makes semi-annual tests and improves bonding where current is escaping; telephone company makes regular tests and bonds cables together at manholes; little damage reported in past eleven years, 6-inch pipe destroyed two years ago, telephone company has had several cable lengths seriously injured.

Great Falls, Mont.: Telephone company makes semi-annual tests; no damage reported by them or by water works.

Helena, Mont.: No tests; water pipe bonded to rails at one point; telephone cables bonded together at manholes; no damage reported but actual condition of water mains is unknown.

Missoula, Mont.: Traction line is new and no electrolysis troubles have yet developed.

Elmira, N. Y.: No tests; telephone cables bonded to water mains in two places; no trouble reported.

Hornell, N. Y.: No tests; rails rebonded since electrolysis was discovered on two streets; 6-inch main burst last summer on account of electrolysis. Condition of other mains not known.

Jamestown, N. Y.: Tests in 1908 showed positive currents of ½ to 22 volts and negative of ½ to 39 volts in western

part of city; heavier rails have been laid since; no breaks from electrolysis.

Niagara Falls, N. Y.: One telephone company makes periodical tests and bonds or grounds as is found necessary; water company and city make no tests; little known of conditions; a 4-inch cast-iron main was destroyed by electrolysis some 6 or 7 years ago; no damage reported by water company since.

Portland, Ore.: Efficiency of bonding system tested by street railway under ordinance every three months, gradually rebuilding system; no return except connections between rails and negative bus bars; gas and telephone companies report practically no trouble; trouble with water mains in eastern section of city, wrought-iron mains being affected somewhat, but none in western section recently.

McKeesport, Pa.: No tests by city; telephone companies make frequent regular tests, grounding cable sheaths when necessary; no damage reported to either water or telephone systems.

Woonsocket, R. I.: No recent tests; a few service pipes slightly pitted, but no evidence of foreign current.

Beaumont, Tex.: Telephone company makes irregular tests, and have bonded cables at each manhole to an overhead return feeder to the street railway power house; formerly had trouble but none now; about two years ago a piece of 6-inch water main was found badly pitted by electrolysis; street railway tracks not adequately bonded and may cause future trouble.

Spokane, Wash.: Telephone company makes regular tests, city does not; one street railway company has both riveted and soldered bond and is connected with underground return feeders, other company has copper-bonded rails only; telephone cables bonded to return feeders of street railway; no damage reported to gas or water mains and to a few service pipes near the power house, only; greater future damage anticipated with increasing traffic and weight of rolling stock.

Record of City Improvements.

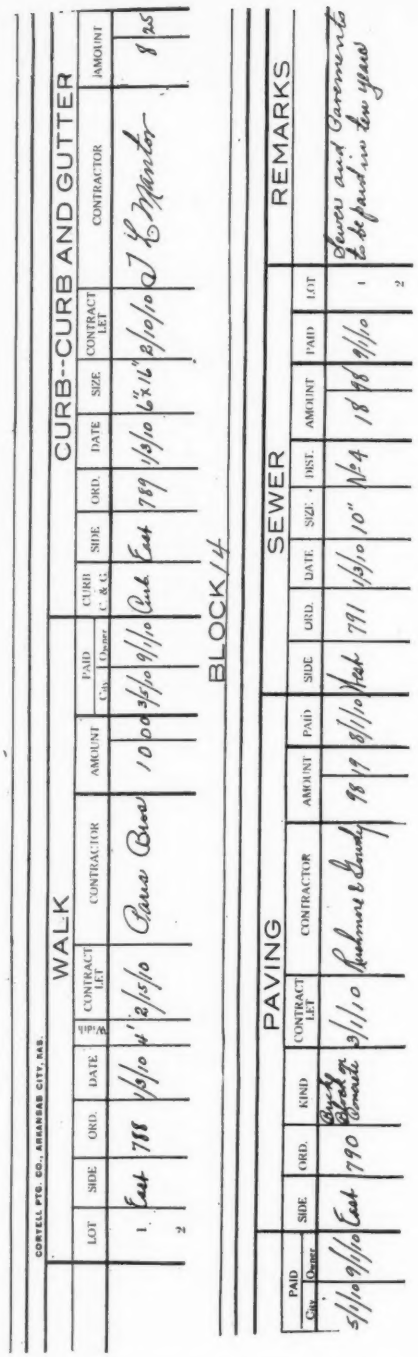
To the Editor of MUNICIPAL ENGINEERING:

Sir: I am enclosing a sheet out of my "Improvement Record Book" which I think will explain itself, and I thought it might be of use to some other engineer. I find it very handy. If a man comes in and wants to know if there has been any improvement ordered in on his property, it only takes a few moments to tell him when it was ordered in, name of contractor, amount it will cost, and how long he has to pay for it.

I want to take this opportunity to tell you that I think MUNICIPAL ENGINEERING is the best publication for the city engineer. I have been a reader of the magazine for a great many years and have always found you ready to give reliable information on almost any subject that pertains to engineering.

J. H. TITUS, City Engineer,
Arkansas City, Kan.

The record is all on one side of one sheet. The accompanying cut reproduces the heading of the columns, which have been separated into two groups for convenience in the reproduction. One line is filled in to show how it is operated in practice.



The left-hand column has printed numbers of lots to correspond with the custom of numbering lots in vogue in Arkansas City. Printed along the side of the column of "Remarks" is the following:

"NOTE—This system installed by J. H. Titus, City Engineer, Sept. 1, 1910. All notes prior to April 1, 1910, were taken from old records in office."

The sheets are perforated at the left-hand end for binding in a loose-leaf binder.

Reinforcement for Concrete Pavements or Floors.

Charlton H. Sayre, of Camden, N. J., sends a description of a method of holding the upper or wearing surface of a concrete floor, walk or pavement in tight engagement with the lower or foundation layer, from which the following is abstracted, showing one of the principal points in his inventions: When the foundation or lower layer of the pavement or floor is laid, its upper surface is scored crosswise and longitudinally by grooves running in squares with diagonals across the squares, which are V-shaped Over this surface is laid coarse-mesh woven wire, and on top of this is laid the top layer or wearing surface. The intention of this construction is to hold the two layers together and to prevent the cracking of the top layer by excess of expansion in it over that in the lower layer.

Wood Pavement Specifications Should Be Investigated.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Kindly permit me to use your valuable and unprejudiced publication to ask a few questions regarding the wood block pavement specifications proposed by Mr. George W. Tillson, Chairman, and his committee of the Organization of City Officials for Standardizing Paving Specifications, at the convention of City Engineers, etc., from about 32 of the 992 cities of the United States, held in New York in January, 1911.

When we remember that all the cities of our country expend about $80,000,000 annually on their streets, and that a large part of this is assessed directly against abutting property holders, we realize the importance of publicity, efficiency, economy and the adoption of contracts and specifications requiring good work and open competition.

While the specifications for asphalt, brick and other groups of pavements than wood, suggested at the convention, seem to be open to wide competition, careful study of what the above committee proposed for wood, suggests some very important questions, the answer to which in each case seems possibly to be in the affirmative.

1. Do the specifications in question exclude the use of regular, commercial, genuine creosote oil of standard specific gravity between 1.03 and 1.07, in successful use for many years, and provide for a product of coal tar of a specific gravity between 1.10 and 1.14, which necessarily contains an excess of free carbon or coke and relatively little creosote?

2. Does the excess of free carbon, coke, etc., prevent the oily part of the coal-tar product from properly saturating the wood?

3. Are the oily portions of the proposed tar product a poorer preservative of wood than regular creosote oil used and in wood pavements still in good condition after eight or ten years' use?

4. Are the specifications in question relatively new and untried as compared with many old and successful ones in our country and Europe?

5. The title of the committee being "Creosoted Block," does the omission of the word creosote oil from the specifications, and the substitution of such words as "coal-tar product," indicate that the specifications are not in accord with the title of the committee or with the specifications intended?

6. Did the chairman and his committee overlook the success of many other kinds and preparations of wood block pavements in many cities, existing for many years, and prevent the repetition of those very successes in our cities; provided the cities adopt the specifications in question?

7. Did the committee sit with closed doors at all of its sessions and under the guidance of its chairman or otherwise, admit, one at a time, only such persons as it desired and exclude from being heard several engineers from several cities, well qualified to give valuable information? Did the committee thus exclude facts and evidence?

8. Is a "coal-tar product," coming within the requirements of the proposed specifications, practically controlled through by-products of a patented or two patented processes, under contract with one firm?

9. Is regular, genuine creosote oil obtainable in small and large quantities, to suit any buyer, and with reasonably prompt deliveries?

10. Are there several competing sources of production of regular creosote oil in the United States and Europe?

11. Is the opposite of Questions 9 and 10 practically true as the coal-tar product suggested in the specifications under investigation?

12. Is it a fact that the heavy, carbon or coke-filled coal-tar product, called for by the said specifications, is cheaper to produce and sold at a higher price than genuine creosote oil to be had everywhere?

13. Were some of the men and experts appearing before the said committee in the pay of or influenced by interests desiring the specifications in question?

14. Are the wood preserving plants, which make paving blocks, as well as the

paving contractors in each city and the taxpayers, all possible victims of a special kind of tar products, where wood block pavements may have been constructed under said specifications suggested in 1910 and 1911, and which might be laid in any city adopting the said specifications?

15. Was the committee composed of public officials, under public pay, traveling and meeting at public expense?

16. Were permanent stenographic records of names and statements of persons called or permitted to be heard by the committee, made at public expense, and a copy furnished each of the members and not given to the public, and are such records public property?

17. Are these and other specifications, by order of the "Executive Committee" of said Association of Public Officials, to be "copyrighted" against general public use?

18. Will this copyrighting mean that the employes of the public will copyright, against the public itself, the work for which they are paid by the public?

19. Have unknown influences or methods been employed so that any members of said convention were led to unknowingly approve that which some of them now say they do not really approve and are ready to oppose?

20. In view of the possibility of the specifications of 1910 and 1911 of said organization tending to, if not creating a monopoly, is it not wise to observe if political bosses and venal politicians, not engineers, favor said specifications so as to share in undue profits at the expense of taxpayers?

21. Is it not good policy, right and best, for each city to independently and openly investigate wood pavements and wood pavement specifications, before adopting the ones referred to of 1910 and 1911?

22. Would it not be wise to carefully study the following specification for regular, commercial, genuine creosote oil obtainable from many sources for many years which meet the requirements of the first part of Question 1 and Questions 9 and 10, as follows?

The creosote oil shall be a prepared dead oil of coal tar. It shall not contain more than 3 per cent. of water, and if it does not contain this amount of water a corresponding correction must be made so that an equivalent additional amount of creosote is forced into the blocks. It shall contain only traces of acetic acid and acetates. Its specific gravity at 100 deg. F. (38 deg. C.) shall be at least 1.03 and not more than 1.07, so as to assure its thoroughly penetrating the wood blocks. The residue insoluble by filtration with benzol and chloroform must not exceed 3 per cent. of the weight of the creosote oil. Fractional distillation of 100 grams of the creosote oil shall produce percentages of dry oil by weight within the following limits:

Up to 150 deg. C. (302 deg. F.), not to exceed 2 per cent.

Between 150 deg. C. (302 deg. F.) and 170 deg. C. (338 deg. F.), not to exceed 1.5 per cent.

Between 170 deg. C. (338 deg. F.) and 235 deg. C. (455 deg. F), not to exceed 35 per cent.

Between 235 deg. C. (455 deg. F) and 300 deg. C. (572 deg. F.), not to exceed 35 per cent.

The residue remaining shall be soft and adhesive. The creosote oil shall contain about 25 per cent. of crystallizable naphthalene and at least 15 per cent. anthracene oils. At least 95 per cent. of the creosote oil shall be soluble in carbonbisulphide and equally in a solute alcohol.

Conclusion.—The foregoing questions are submitted with a belief that a full public discussion through MUNICIPAL ENGINEERING will bring out just the facts and results which the city engineers really desire and which cannot be determined at conventions, meeting at long intervals and then only for a few days.

PROGRESSIVE.

The above communication is from a well-known engineer who has made a close study of the subject, and is presented for the purpose of arousing discussion. MUNICIPAL ENGINEERING cannot of its own knowledge answer all the questions in the affirmative, hopes that no one can so answer some of them, and regrets that anyone should think it advisable to ask those referring to individual or collective motives other than the promotion of the public welfare.

Brick Rattler and Brick Specifications.

To the Editor of MUNICIPAL ENGINEERING:

Sir: In order that you may understand fully the attitude of the National Paving Brick Manufacturers' Association regarding the rattler, we are enclosing you herewith a general letter, such as we are sending to many engineers throughout the country, and enclosed with the same is the rattler specification as explained, any and all of which you are at liberty to publish.

WILL P. BLAIR,
Secretary, Indianapolis, Ind.

The letter referred to is as follows:

We are pleased to enclose you a copy of the plans and specifications for the rattler, which is offered to the municipalities of this country by the National Paving Brick Manufacturers' Association, together with the explanation for its development and comment as to its use and purposes which is further explained by the following resolution, adopted by this Association at its annual meeting at Louisville, Ky., under date of February 7, 1911:

"Resolved, That the National Paving Brick Manufacturers' Association condemns the action of the Organization of City Officials for Standardizing Paving Specifications in specifying a three-point increase in the abrasion test to take care of the greatly increased severity of the new standard rattler developed by the National Paving Brick Manufacturers' Association. The old machines were so erratic, one with another, as to make it impossible to ever state the loss sustained in the

new machine as an arbitrary amount over that sustained in the old. Any comparison must of necessity be based upon some definite old machine. Such comparisons as are now available show an increase from five to ten points, varying with the different old machines. It will be necessary for city officials to determine by investigation for themselves what rattler loss they will allow in their specifications."

Calling your attention further to the general recommendations of the Organization of City Officials for Standardizing Paving Specifications which were adopted by that organization at their meeting January 10-14 inclusive, in New York City, we very much regret that the organization saw fit to exclude all discussion from associate members except through committees. The brick committee itself allowed us but one-half hour upon matters which we regard as of the utmost importance to ourselves as well as to the taxpaying public. It was impossible, therefore, to go into the discussion of details which were obviously of so much interest to us. As a result we believe that there were reported to the convention, by the committee, matters with which our own association would have to differ and which perhaps would not have been adopted by either the committee or by the organization itself in the light of full and complete discussion of the same.

The allowed time did not permit any discussion in detail of our No. 1 Directions for Laying Brick Street Pavements. of directors has appointed a committee to carefully consider and revise for a new edition our No. 1 Directions, setting out in explanation more fully our views in all these matters.

It may be that many points are covered in detail which are not expressed as clearly and concisely as should be, and their value was therefore not appreciated to the fullest extent and could not well have been without careful consideration, such as a careful discussion would accomplish.

With the view, however, of correcting anything of this sort and with the hope of having these detailed matters carefully considered in the future, our own board

In the meantime we believe that it will be proven of utmost importance for municipalities to follow as closely as possible the suggestions that are found in our No. 1 Directions, sincerely believing such a course will conserve great economy and satisfaction to the taxpayer and user, as in every case where these specifications have been fully complied with entire satisfaction has resulted.

For your information we are enclosing you a copy of proposition, cost, etc., from Messrs. Hetherington & Berner, who are equipped to furnish rattler and shot.

The rattler specification is practically that published in the February number of MUNICIPAL ENGINEERING, vol. xl, p. 91. Following is the description and price list of parts of rattler, enclosed with the specifications:

	Weight.	Selling Price.	
14—6″x15-lb. channel staves, 35 lbs. ea.	492 lbs.	$21.25)	
14—⅜″x5½″ plate liners, 11.5 lbs. ea.	162 lbs.	8.40)	
2—Heads, No. 1529, 218 lbs. ea.	437 lbs.	23.75)	
2—Head liners, No. 1577, 170 lbs. ea.	340 lbs.	16.25)	
64—¾x2½″ machine bolts		)	Barrel
64—¾″ hex. nuts		6.00)	$75.65
1—C. I. pinion 6.8″P. D.	32 lbs.	$ 3.20	
1—Gear 32⅝ P. D.	190 lbs.	11.00	
1—Clutch pulley 6″x18″	58 lbs.	5.50	
1—Clutch block	14 lbs.	2.65	
2—Side frames, 140 lbs.			
2—End frames, 230 lbs.			
2—Boxes and cap, 51 lbs.			
2—Caps, 20 lbs.			
1—Gear guard, 45 lbs.			
1—Shaft 1 15/16x5.2″, 53 lbs.			
1—Clutch lever and plate, 20 lbs.			
Screws, bolts, etc., 5 lbs.	564 lbs.	52.00	
Totals	2275 lbs.	$150.00	
25—Large spheres, approximately	187.5 lbs.		
325—Small spheres, approximately	325.5 lbs.		
Total	500 lbs. at 4½c.		$22.50

Monument for Locating Sewer Connections.

In your magazine for February, 1911, I notice a description of a monument for sewer connections. In the smaller places I have used a device which is much cheaper than the one described, and which I believe will work as well, if not better.

My plan is to leave in the ditch at each connection, where the connections are not run out to the curb line, a piece of cedar 2x2 inches, which extends from the bottom of the trench to within six inches of the surface of the ground.

The inspector locates these strips of cedar from the last manhole passed, entering the measurements in a notebook kept for the purpose. The original tracing is corrected from this notebook, and filed with the city clerk.

When a property-holder wishes to locate his "Y," he obtains from the clerk the location of the cedar strip, and digs for it. As it is but six inches under the ground, a mistake of a foot or two is not expensive; and when he finds the strip, he has but to follow it down to the connection.

W. H. ALLEN, Assoc. M. Am. Soc. C. E.,
Chehalis, Wash.

Cost of Surface Oiling and Asphalt Macadam Roadways.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Following are some data on the cost of treating roads with oil and laying asphalt macadam which will be of interest to your readers:

1. Surface oiling Van Buren and Sixth streets, Fort Smith, Ark., using Texaco road oil; 13,000 square yards area of street.

Method of Work: The dust on the surface of the road was swept aside thoroughly and the streets sprinkled with Texaco road oil. The dust mixed with a little fine gravel was thrown back over the road oil and rolled.

Time taken on the work was four days; the number of gallons of oil used was 6,000; the amount of oil per square yard, 0.45 gallon; total cost per square yard, $0.048.

2. Oiling Nine Streets in Kingston, Pa., with Texaco Road Oil.—Ridge, Pierce, South Wyoming, Myers, Maple, Hoyt, Slocum, Centre and Payne streets and avenues.

Total length, 5,000 feet; amount of oil used, 75 barrels; total square yards, 9,333 1/3; number of gallons used, 3,936 at 5 1/5 cents per gallon; cost, $204.67; cost of application, 79 yards at 20 cents, $15.80; cost of hauling from car, $8.40; total cost, $228.87; cost per square yard, $0.023; oil used per square yard, 0.42 gallon.

3. Laying Asphalt Macadam, Cold Mixing Method, at Pawtucket, R. I.—Total yardage of work, 1,847 square yards. Built on three grades, 14.63, 1 and 8 per cent. respectively. Six inches of broken stone macadam laid on subgrade and surface mixture of three inches of stone mixed cold with Texaco macadam binder.

The mixer used on this work was a batch concrete mixer set up on the work.

The stone was dumped into the mixer from barrels and Texaco macadam binder, previously heated, drawn from the kettle and dumped into the mixer at a temperature of about 300.

Average time of mixing, three minutes.

The following men were employed on the work:

1 kettle man	$2.00
1 helper	1.75
2 men drawing asphalt, each	1.75
2 men wheeling crushed stone to mixer, each	1.75
2 men wheeling mixed material to street, each	1.75
1 raker	3.00

The stone used on this work was crushed by the city and was hauled about three miles to the work at a cost of about $2.00 per cubic yard.

The concrete mixer was capable of turning out one-sixth of a cubic yard to the batch. A mixer capable of turning out four or five times the amount of work could be operated with practically the same working force.

The work was done by city employes and there was no deduction from the labor on account of delays due to wet weather.

The average working day was only six hours during the whole of the work.

H. T., New York City.

Binder for Highway Construction.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I have been a street and road builder in this State for a number of years past, making a special study of this subject. The road commissioner and county officials are now face to face with a serious problem. The immense automobile traffic across this State is cutting into the macadam roads at a terriffic rate. Hundreds of miles of roads are now badly in need of repairs.

The road commissioner has been experimenting with oil as a dust binder, but it has proved to be a failure, being wet and sticky all winter.

I have advocated asphalt sand and stone as a durable and satisfactory binder. Has anyone a better one to offer?

T. J. MCGOVERN, Trenton, N. J.

Sewage Plant at LaGrange, Ill.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The sewer and disposal plant at LaGrange, Ill., bids for which were received February 1, 1911, will be a very interesting piece of work. The sewer, 72 inches in diameter, will take the place of an old one, the flow of which will have to be taken care of during construction. The 15-inch tile sewer is to be encased in concrete alongside of the 72-inch sewer and will carry the sewage under pressure. The sewage is carried under the bed of a creek and empties into two automatic dosing chambers which discharge onto the filter beds.

EDWIN HANCOCK, JR.,
2047 Ogden Ave., Chicago.

Water Works of Phelps, N. Y.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We have three reservoirs in use, fed from springs: fire reservoir, 50x100x16 feet; domestic reservoir, 20x30x5 feet, and Basset reservoir, 35x35x6 feet, all in use.

We have no new work in contemplation except development of additional springs, with a possibility of driving one or more wells. All springs are above the reservoirs, and the pressure is from 65 to 90 pounds or over, depending upon location in the village and the reservoirs in use, the first two mentioned giving 10 pounds' pressure more than the third or Bassett reservoir.

CORLISS MCKINNEY,
Supt. Water Works.

How to Find Area of Segment of Circle.

I notice an inquiry in your February number, from "M. G. H.," Memphis, Tenn., asking for some short method of ascertaining the approximate area of a segment.

The result obtained from the following is in error, 1 part in about 175.

$$\text{Approx. area of segment} = \frac{2hc}{3} + \frac{h^3}{2c}$$

in which H equals mid. ord., and C equals chord.

H. B. MURDOCK,
Oakland, Cal.

Some Varieties of Sanitary Science.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Sanitarians and engineers have made wonderful progress in the science and art of water purification during the last ten years. Many cities taking sewage polluted streams for their source of water supply and applying modern scientific methods of purification and sterilization have some of the lowest typhoid fever death rates in the country. The same is true of many cities in Europe. Purification plants such as those installed at Washington, D. C.; Philadelphia, Pa.; Pittsburg, Pa.; St. Louis, Mo.; Cincinnati, Ohio; Albany, N. Y.; Indianapolis, Ind.; McKeesport, Pa.; Columbus, Ohio, and many others, all put in by the foremost engineers and sanitarians in this country, can no longer be considered as merely in their experimental stages. Proved statistics and scientific analyses are daily showing what these systems are accomplishing in the way of reduced death rates in these cities.

When we consider all that has been accomplished by purification installations in the way of reduced typhoid fever death rates in the many cities in this country, the making of such statements as those made recently by state officials of Oklahoma seems almost past believing.

Some six months ago the writer was called in by the cities of Muskogee and Oklahoma City to design for them adequate and improved water supplies, and in the case of Muskogee improved sewerage facilities and garbage disposal. In Oklahoma City the contract included the investigation of every possible source of water supply for that city, and the recommendation of that source and plan, which in the engineering judgment seemed wisest, best and most economical for the city to adopt.

Oklahoma City has for many years been obtaining its water from the North Canadian river, the average flow of which throughout the year is somewhere in the vicinity of three hundred cubic feet per second. After a careful consideration of every other possible and impossible source of supply suggested by citizens and other engineers, the plan recommended by the writer included the construction of a dam upon this river, impounding about 8,000,000,000 gallons of water, sufficient to carry the city of Oklahoma City over a period of over a year's drought, and a complete water softening, purification and sterilization plant.

About one hundred miles up stream, measured along the meanderings of the North Canadian river, is situated the town of El Reno, with a population of about 8,000 people; approximately fifty or sixty miles further up is another small town of about 2,000. Neither of these towns have complete sewerage systems, the average discharge of sewage at El Reno being one-third of a cubic foot per second, as compared with an average stream flow of 300 cubic feet per second. The town of Yukon (population 1,000), situated at a river distance of sixteen miles, is at the present time installing a sewage disposal plant. Although the plans provided for a complete and thoroughly up-to-date filtration and softening plant, including sterilization, the writer took the precaution to point out the advisability of the city's taking immediate action to see to it that the towns above were compelled to adopt some rational method of sewage purification before discharging the sewage effluent into the North Canadian river.

The question of voting a million and a quarter dollars of bonds to carry out the proposed plan for an improved water supply was before the people of Oklahoma City for seven weeks, and received the endorsement of the Chamber of Commerce, a citizens' committee, appointed to investigate the entire proposition, the Oklahoma State Engineering Society, and most of the most reliable men of the community. The need of the city was very great, for during two or three months of the years 1902 and 1903, the river went practically dry; but the population of Oklahoma City at that time was only about 10,000 people. The present population of Oklahoma City is about 65,000 people, and during the past summer the flow of the river was not sufficient to supply the ordinary demands made upon it, and for many hours the pumps had to be shut down and the city left without any fire protection whatever. Nor has the city a present supply sufficient to offer water to new industries, or to extend its mains.

The campaign of opposition to the bond issue was opened by state officials in a letter published in the *Daily Pointer*, from which the following sample sentences are quoted:

It is proposed that Tuesday we shall vote a million and a quarter dollars' bond issue for a water supply, and up to a few days ago the most of us supposed we were going to get water. Since then some frightful facts have been disclosed to us, facts in regard to this water, which means devastation and death unless somebody puts a stop to it; and because no-

body else seemed willing to undertake to warn the people, I have accepted this grave responsibility and unpleasant duty.

Now, Mr. Voter, I wish to ask you some questions. Do you wish to drink liquid sewage? Do you wish to have the offal and filth from the sewers of El Reno and Yukon dumped into the water you drink?....Do you wish the death rate of Oklahoma City to increase until it drives the tenants from your buildings and frightens investors away?....I am perfectly willing, personally, and I am a taxpayer, to pay twenty dollars a year for forty years for clean, wholesome water; but not one cent have I for sewage and filth. And while I live it shall be over my protest that any engineer, for any amount of money, be permitted to feed liquid sewage to the helpless poor.

Signed by Kate Barnard, who is State Commissioner of Charities and Corrections. Again:

I told them if they would wait ten days and pass a law through the legislature, compelling the use of sewage farms, such as they have in Europe and many states of America, thus removing the sewage from our water supply, I would then stand for the bonds.

A letter of the State Health Commissioner was published in the *Daily Times*, in part as follows, including misused words:

Replying to your request for my opinion as a health officer as to whether or not a stream like the North Canadian river, that is now sewerage polluted and continually receiving every day additional sewerage pollution, can be dammed up and the water from the same be made a good and wholesome water for domestic purposes and used without endangering the health of those who use it for drinking purposes, I beg to advise, that personally my opinion would be that it could not be sufficiently purified, unless the sewers were removed and the river policed, so as to prevent a continuation of the contamination. In Ohio, Indiana and Kansas an aggressive fight is being waged against the further contamination of the running streams of water now used by municipalities for domestic purposes.

Signed by C. H. Mahr, State Commissioner of Health.

Concerning the El Reno and Yukon sewage entering the river, the state chemist, Dr. De Barr, made the following statement:

After entering the stream no treatment that will make the water safe as a drinking water for Oklahoma City can be applied to remove the evil effects of this sewerage. The only way is to not allow this sewerage to enter the reservoir, if you expect a pure water for Oklahoma City.

In view of the above statements, made by the scientists of the State of Oklahoma, it is interesting to remember that the water entering the Columbus, Ohio, storage reservoir, is polluted by a tributary population of 70 persons to the square mile; while the tributary pollution at the proposed reservoir at Oklahoma City is at the present time not more than five persons per square mile. The water shed of the Scioto river, from which Columbus draws its water supply, is 1,035 square miles, and that of the North Canadian river is 15,000 square miles. In others words, the proportion of pollution in the Columbus reservoir to that of the proposed Oklahoma City reservoir is as 16 to 1.

The state geologist, Charles N. Gould, added his word to this controversy. In speaking of the proposed reservoir and purification and softening plan he says:

The quality of the water will not be materially improved. The people of Oklahoma City will continue to drink the sewerage of El Reno and other towns. The dead horses and cattle from the hundreds of farms and Indian allotments in western Oklahoma will still be dumped into the river, and many of them will wash down into the reservoir. The water will always be hard and will require the constant use of chemicals.

According to government statistics on file in the office of the state board of health, Oklahoma leads other large cities in the percentage of typhoid cases. Bacteriologists tell us that no stream or reservoir will purify itself, and that no filter so far designed will take out all the typhoid germs. The fact that the people of other cities, such as Pittsburg and Wheeling drink sewerage and die of typhoid is of itself no reason why the people of Oklahoma City should do the same thing.

ALEXANDER POTTER, New York City.

The above is printed as a contribution to the information regarding the necessity of education in safe and sane sanitation. Can any of our Oklahoma readers or others having local knowledge add anything of value? No personal controversy can be permitted, but it is evident that some void must be filled if the highest principles of economy and of sanitary science are to be followed in this rapidly growing state.

An Automatic Sewage Pumping Station.

The city of Indianapolis has just installed a small automatic sewage pumping apparatus to pump into the large intercepting sewer, on the southeast side of Fall Creek, the sewage from a small intercepting sewer and a small separate system of sewers. The accompanying cut shows the whole installation except the extension of the 5-inch pipe across the Fall Creek bridge and down into a manhole, and a connection with the White River Intercepter.

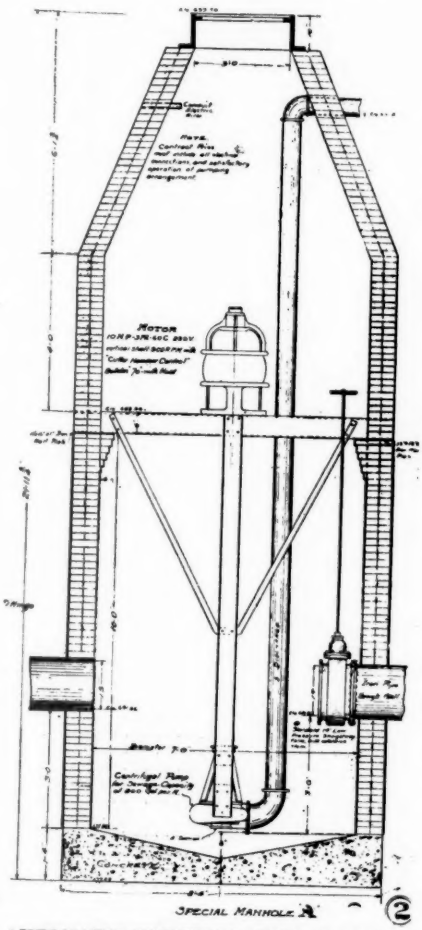
The inlet, as shown, is a 15-inch pipe, which is fitted with a wire basket to catch sticks and large refuse which might injure the pump.

The 16-inch centrifugal pump has a capacity of 800 gallons a minute. It is run by a 10-h. p. 3-phase, 60-cycle, 220-volt motor, running the vertical shaft at 900 r. p. m. The motor has the Cutler hammer control, operated by a float, balanced by a weight, this apparatus not being shown in the drawing.

The apparatus is set in a manhole 7

feet in diameter and 22 feet deep, on a steel framework, as shown.

There is an overflow from the last previous manhole on the 15-inch sewer into Fall Creek, for use in case there is difficulty with the pump, and the 15-inch iron pipe, shown through the wall opposite the inlet, has a gate valve, which can be opened to make another connection with Fall Creek directly from the pump manhole.



AUTOMATIC ELECTRIC SEWAGE PUMPING STATION, INDIANAPOLIS, IND.

There are about 300 feet of 5-inch iron pipe from the pump to the sewer on the opposite side of the creek. This pipe has four vertical T's with plugs, removable in case of stoppage in the pipe for purposes of cleaning. This 5-inch pipe discharges into a short horizontal 10-inch vitrified pipe, which in turn discharges into the White River Intercepter near its crown.

The pipe and placing cost, $238; the pump and motor cost, $610, and the total cost of the installation, including all connections, manholes, pipes, valves and relaying 878 feet of 12-inch vitrified pipe sewer to new grade, was $2,400.

At a recent visit, with a full discharge of very dilute sewage into the manhole, the pump operated automatically one minute in every three minutes. There is not much more than 2 feet difference between high and low water in the manhole, the depth from flow-line of inlet to base of pump being 3 feet. There being no flap or check valve on the outlet pipe, some 100 feet or more of the pipe was emptied back into the pump manhole each time the pump stopped. This caused the pump to run backward for nearly one minute in each three, and this water must be pumped back into the pipe each time the pump starts.

With somewhat different setting the same pump could be used for a deeper well, and the storage chamber could be larger if necessary.

The Electrolytic Sewage Treatment Plant at Santa Monica, Cal.

To the Editor of MUNICIPAL ENGINEERING:

Sir: The magneto-electrolytic sewage purification plant at Santa Monica, Cal., the only one in practical operation in the United States, having been in successful use for a year and a half, continues to be the subject of inquiry on the part of the Boards of Health throughout the United States and all parts of the world. An inquiry has just been received from Calvin S. White, State Health Officer for the state of Oregon, who says: "The matter of sewage disposal is one of the many problems that this state has to serve, and we are exceedingly anxious to construct a working model fashioned after the one in use in your city. Please send me every detail alnd explicit directions for constructing a model such as you have in use that we may be able to conduct it experimentally here in the laboratory and perhaps advise its use in some of the inland cities of our state."

City Engineer James has furnished the following information, as the result of the practical experience of Santa Monica:

Replying to your inquiry relative to the magneto-electrolytic plant for treating crude sewage within our city, I would say that the plant is giving good results and is kept in constant operation, excepting for a period of about one hour of each twenty-four on account of flushing the flumes and washing off the plates by the use of water from a common pipe and hose. The actual time required to attend to the plant would be about three to five hours per day. Everything is practically automatic, excepting for the exchange of pumps. We use a No. 4 centrifugal pump most of the time, also a No. 6 Byron Jackson slime and sewage pump, low pressure, is put in operation at certain intervals of time to lift all of the sludge or silt within the receiving basin.

The receiving basin is concave in form and of a capacity of 30,000 gallons. The

forebay, or conduit, used as an equalization chamber has a capacity of 7,000 gallons. The sewage is never allowed to come to absolute rest. The forebay has a gradient of 0.444 per cent. and is constructed in a sealed manner, excepting at the gates. The only vent necessary at the plant is in proximity to the weir for discharge of the effluent after treatment. At this point hydrogen gas is released and a vertical 6-inch galvanized pipe takes care of it and it is carried to a height of about 60 feet above the surface of the street.

We are now treating about 550,000 gallons per twenty-four hours. The depth of flow within the flumes is usually about 15 inches, or about 2 inches over the top of the electrodes.

The estimated expense of treating the sewage by the magneto-electrolytic process, exclusive of pumping said sewage, for a city of 75,000 population, would be about $5,000 per annum, which includes renewals of plates, etc. The best results are obtained in the treatment for deodorization of sewage in accordance to my judgment and practical knowledge by arranging it in some way so that the sewage is thoroughly churned, either by being allowed to flow within a pipe for a distance of about one mile beyond the last discharge into the sewer mains of house service pipe, or a rotary agitator could be placed within the receiving basin.

Our monthly expense for conducting the plant, including the pumping of sewage, is about $400; providing 1,000,000 gallons had to be treated and pumped the cost would be about $600 per month. We pay a flat rate of 3 cents per kilowatt hour for electric energy, which is about 40 per cent. above the average price paid in most cities. The original cost of installing the plant, including the forebay and buildings, was about $18,000.

C. B. IRVINE,
Santa Monica, Cal.

Electric Centrifugal Pumps for Great Falls, Mont.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The growing demand for water for domestic and street irrigation purposes, and the deterioration of the city's steam plant brought the question of better pumping facilities to an issue. Accordingly, in March, 1910, the city council ordered the installation of two centrifugal pump units, each of 2,000,000 gallons daily capacity. This was the beginning of the change over from steam to electric-driven pumps. The completion of the large electric plant of the Great Falls Power Company, at Rainbow Falls, made an uninterrupted service practically certain. The work involved consisted of the removal of two Gordon compound steam pumps and the building in the same location of a pit 22x40x14 feet deep, designed to accommodate five two-million-gallon centrifugal units.

The building of this pit was rendered difficult because of the fact that two of the side walls were built under and supported the main building walls. Another wall was six feet from and extended eleven feet below the boiler room wall, while the other wall was adjacent to and extended below the large Holly pump foundation, which apparently had been very loosely built. No interruption of service or trouble was experienced, and the two Worthington 2-stage pumps, with 150 h. p. General Electric motors, were put into service September 20, 1910. On the test run these pumps showed a delivery of 30 per cent. above specifications at the required pressure, and a pressure 16 per cent. above specifications at the required discharge.

Two additional pumps of the same type were ordered by the city council on February 6, 1911, and when installed the water service will be on a more economical basis than ever before.

The betterment of the water supply is being urged, and although a number of propositions have been suggested, the indications point to a filtration plant as the best solution of the matter.

Plans have recently been adopted to be followed out in future water main extensions, which provide finally for a complete gridironing and cross mains of 8, 12 and 16 inches in diameter.

H. C. ALLEN, City Engineer,
Great Falls, Mont.

Cost of Oiled Macadam.

Following is the detailed actual cost per square yard for treating a road two miles long with standard macadam binder A. No allowance is made for rental or depreciation of machinery. The average haul for oil and sand was 1½ miles. Two applications of oil, each ¼ gallon, were made about a week apart. The figures are supplied by Arthur W. Dean, M. Am. Soc. C. E., chief engineer of the Massachusetts Highway Commission. The figures given are the average cost per square yard for the whole work.

Cleaning and sweeping	$0.0056
Patching old surface	.0016
Cost of oil	.0319
Heating oil	.0031
Delivering oil	.0038
Distributing oil	.0029
Furnishing sand beside road	.0165
Spreading sand	.0073
Watering	.0012
Rolling	.0002
Supervision	.0025
	$0.0766

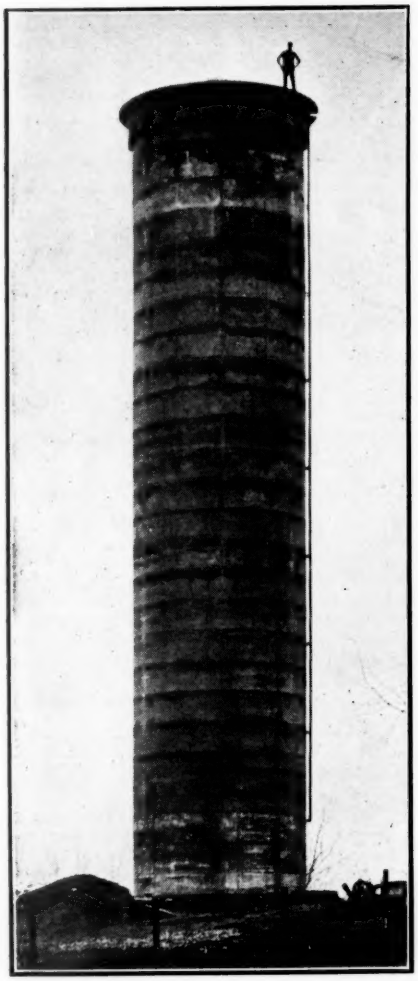
Reinforced Concrete Standpipe.

I enclose you a photograph of the standpipe just completed for the city of Waverly, O.

It is of steel concrete, 82 feet from top of foundation to cornice, and the roof, including thickness of cornice, is 4 feet, making a total height of 86 feet. The outside diameter of shell is 18 feet. The first 9 feet of shell is 12 inches thick; then 45 feet 9 inches thick, and balance of height is 6 inches thick. The founda-

tion is 7 feet deep, octagon, and 22 feet in diameter. Capacity, 120,000 gallons.

The structure was built by J. L. H. Barr, of Batavia, O., under the direction



REINFORCED CONCRETE STANDPIPE AT WAVERLEY, OHIO.

and in accordance with the plans of H. C. Babbitt, of Lockland, O., consultling engineer. The cost was about $4,500.

J. L. H. BARR,
Contractor, Batavia, O.

Information for Contractors.

Accompanying the printed detailed advertisement for bids for paving, curb and gutter in Creston, Ia., is the following interesting and valuable information for contractors, supplied by the engineer in charge:

I enclose herewith advertisement for bids for paving at Corning, Ia., of which I am in charge.

Brick specifications require a 24 per cent. rattler test and 3 per cent. absorption test on rattled brick. There is no local prejudice as to brick or any other material.

Some producers of other material required are: Crushed stone—Peru Sand and Cement Co., Peru, Ia.; McManus & Tucker, Keokuk, Ia.; National Stone Co., Omaha, Neb.; C. W. Hull Co., Omaha, Neb., and C. B. Havens Co., Omaha, Neb. Sand—Des Moines Sand Co., Des Moines and Red Oak, Ia.; Cline & Shaw Fuel Co., Creston, Ia.; Ottumwa Sand Co., Ottumwa, Ia.; Coon River Sand Co., Des Moines, Ia.; Lyman Sand Co., Omaha, Neb., and I. Q. Gibson, Red Oak, Ia. Sand for cushion layer can probably be secured locally. Gravel—Coon River Sand Co., and Des Moines Sand Co., both of Des Moines, Ia.; also I. Q. Gibson, Red Oak, Ia., and Platte Gravel Co., Omaha, Neb. Portland Cement—Local representatives of various standard brands.

The following approximate outline of local conditions is given for your convenience:

Unskilled labor, 20 cents an hour; man and team, 40 cents an hour. Labor unorganized.

Average haul from tracks to work, one-fourth mile, up moderate grade.

Grading haul, practically all down hill.

Surface soil, black loam; subsoil, joint clay; no rock or gravel.

Certificates worth 95 cents to par. Probably can be placed locally.

City Council harmonious.

Water supply municipally owned and available at all points of the work.

Engineer will exercise no preference as to source or brand of material. Any material complying with the specifications will be acceptable.

Complete plans and specifications are on file with the city clerk at Corning, Ia., and with the undersigned at this place. Copies will be mailed by the undersigned on receipt of $2.00 per copy.

Bidding blanks will be furnished by the city clerk.

Corning has a local exchange of the Mutual telephone and a toll office of the Iowa or Bell system. Creston has a Mutual exchange and a toll office of the Bell system. Please use the system having local exchange in the place called whenever possible in making long distance calls.

Trusting that we may have the pleasure of considering your bid, I am,

Yours very truly,
THEO. S. DELAY,
Engineer in Charge.

MUNICIPAL IMPROVEMENTS 1910-1911

CONSTRUCTION REPORTS FROM CITIES AND TOWNS

Streets, Sidewalks, Curb and Gutter, Sewers, Sewage Disposal, Water Works, Electric Light, Gas, Garbage, Fire Apparatus and Buildings

Believing that the prospects for work in the line of municipal improvements this year are better than they have ever been, MUNICIPAL ENGINEERING considers it a part of its duty to give as full a report as possible of the work actually done during the past year and that which there is probability of doing during the coming year.

With the intention of making the information as authentic as possible, requests were made of city officials in the principal cities in all the States for statements of the work completed in 1910, the work for which contracts were let in 1910 and which is not yet completed, and the work which is possible for the following year. As to the first two items there can be no difference of opinion. Some engineers may omit the small jobs which amount to but little and are done by local contractors, and so the reports may not cover every particle of work done, but they do cover all of any importance. As to the work in prospect for the next season, some engineers do not report because budgets are not yet complete, or because councils or boards have not yet determined upon the exact contracts to be let. Some report such contracts as are now pending and omit those which may come up later, but are not yet in the official line, while others report all the work which has been petitioned for, whether there is any prospect for construction or not. The report nearest the probabilities is, of course, the one which gives the engineer's best judgment of what work will be started during the year. Some engineers have made this kind of report. Unfortunately, there can be no certain way of determining which sort of report has been made. Therefore, as regards any single city, the results of the year may not have been accurately forecast. But for the cities reported upon as a whole a summary of the reports will give a very close approximation to the total amount of work to be done.

This special construction number of MUNICIPAL ENGINEERING is so pre-eminently a practical number that no theoretical discussion of the result of this collection of data will be attempted.

Our indebtedness to the municipal officials of the country has been doubled since acknowledgment of it was made in "Editorial Comment," for the number of reports received has doubled, and still they come, and the stream can only be cut off by putting the forms on the press. This miscalculation of the generosity of our correspondents has caused such an extension of the space demanded for the reports that everything except the tabulations has been relegated to second place and crowded to the rear or out of sight entirely. This material has not been lost, however, for such as is not put out of date by a month's delay will be given later.

The tables following have been derived from reports made by city engineers, city clerks, boards of public works with various forms of title, superintendents of streets, sewers, electric light, gas, water, garbage disposal and other plants, full acknowledgement of the courtesies of whom can only be made in this general but none the less hearty and sincere manner.

They are arranged in the following order:

Street pavements,
Sidewalks,
Curb and gutter,
Sewers,
Sewage disposal and pumping plants,
Water distribution systems,
Water supply systems, including special items connected with the service to consumers,
Electric lighting systems,
Gas lighting systems,
Garbage collection and disposal,
Street signs,
Fire department buildings, apparatus and supplies.

It is, of course, impossible even for the census department of the United States government to obtain reports from all cities, but the response has been unexpectedly generous, and, while there will be disappointment at the failure of certain cities to respond, even to the final telegrams to hurry up reports, the cities which have supplied information are so numerous and so well distributed over the country that one can well estimate the probabilities of a district, and even of the missing cities, from a study of the data given.

STREET IMPROVEMENTS

Official Reports of Street Improvements Made to Municipal Engineering by the Municipal Officials of America

Arranged alphabetically by states and cities. In the line "1910" under each city is given the number of linear feet of each class of pavement laid in the year 1910.

In the line "Progress" is given the number of linear feet of each class of pavement in process of construction.

In the line "1911" is given the number of linear feet of each class of pavement proposed for construction during 1911, printed in heavy type so that it can be distinguished readily.

The reports have been reduced to the same unit of linear feet. When the area of streets was given in square yards it has been reduced to linear feet by assuming the average width of street as 30 feet.

Under "Asphalt" are included the few reports of block asphalt as well as the sheet asphalt. Under "Granite" are included Belgian block as well as the ordinary granite blocks. Under "Concrete" are included Blome concrete, granitoid, Hassam and trappoid pavements. Under "Wood" are included wooden block and plank. Under "Bituminous Macadam" are included asphaltic concrete, asphaltic macadam, bitumen, bituminous macadam, filbertine, Ford macadam, gravel and oil, mineral rubber asphalt or concrete or Sarco mineral rubber, oileroid, oiled macadam, petrolithic, siliciamma, slag tar macadam, surface oil with and without surface coat of gravel, tar macadam, tarvia, westrumite and doubtless others whose trade names were not given in the reports.

ALABAMA.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Birmingham—									
Progress	16,969	16,666	4,848	.....	.....	.....	5,666	15,151	.....
1911	.....	**21,212**	**12,121**	.....	.....	.....	.....	**15,151**	.....
Dothan—									
1910	.....	.....	5,400	.....	.....	.....	.....	.....	.....
1911	.....	.....	**180**	.....	.....	.....	.....	.....	.....
Jasper—									Clay
1910	.....	.....	.....	.....	.....	.....	.....	.....	5,280
1911	.....	.....	.....	.....	.....	.....	.....	.....	**15,800**
New Decatur—									
1910	.....	.....	.....	.....	.....	.....	.....	3,000	.....
Progress	.....	.....	.....	.....	.....	.....	.....	9,000	.....
1911	.....	.....	.....	.....	.....	.....	.....	**6,000**	.....

ARKANSAS.

Batesville—									Gravel
1910	.....	.....	.....	.....	.....	.....	.....	.....	3,000
Ft. Smith—									
1910	.....	.....	18,500	.....	.....	31,700	.....	.....	.....
1911	.....	.....	**29,000**	.....	**9,000**	**10,560**	.....	.....	.....

CALIFORNIA.

Alhambra—									
1910	2,500	.....	.....	.....	.....	18,500	.....	10,560	.....
Progress	.....	.....	.....	.....	.....	7,900	.....	9,200	.....
1911	**13,300**	.....	.....	.....	.....	**35,600**	.....	**7,900**	.....
Antioch—									
1911	.....	.....	.....	.....	.....	.....	.....	**15,800**	.....
Coalinga—									
1911	.....	.....	.....	.....	.....	.....	.....	**4,100**	.....
E. San Jose—									
1910	.....	.....	.....	.....	.....	.....	3,960	.....	.....
Progress	.....	.....	.....	.....	.....	.....	2,640	.....	.....
1911	.....	.....	.....	.....	.....	.....	**31,700**	.....	.....
Emeryville—									
1910	.....	.....	.....	.....	.....	2,700	.....	3,700	.....
Lodi—									
1911	**3,600**	.....	.....	.....	.....	.....	.....	.....	.....
Long Beach—									
1910	5,280	.....	.....	.....	.....	.....	.....	48,700	.....
1911	.....	**9,000**	.....	.....	.....	.....	.....	.....	.....
Los Angeles—									
1910	94,200	.....	2,710	.....	.....	19,200	.....	64,500	.....
Progress	60,900	.....	.....	.....	.....	.....	.....	47,600	.....
1911	**132,500**	.....	.....	.....	.....	.....	.....	**79,400**	.....
Oakland—									
1910	37,000	5,280	690	.....	.....	118,500	950	23,100	.....
Progress	16,900	.....	.....	.....	.....	62,500	.....	26,400	.....
1911	**52,800**	.....	.....	.....	.....	**132,000**	.....	**52,800**	.....
Palo Alto—									
1910	3,820	7,200	.....	.....	.....	.....	.....	.....	.....
1911	**666**	**2,000**	.....	.....	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Pasadena—									
1910....	5,100	.....	.....	.....	.....	16,700	.....	70,000	.....
Progress	960	.....	.....	.....	.....	25,800	.....	5,400	.....
1911....	.....	**7,970**	**2,200**	.....	.....	**17,500**	.....	**10,600**	.....
Portersville—									
1910....	4,000	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**10,800**	.....	.....	.....	.....	.....	.....	.....	.....
San Bernardino—									
1910....	7,920	.....	.....	.....	.....	.....	.....	39,600	.....
Progress	.....	.....	.....	.....	.....	.....	.....	5,280	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**10,560**	.....
San Jose—									
1910....	340,000	.....	.....	.....	.....	.....	.....	.....	.....
Progress	4,200	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**18,500**	.....	.....	.....	.....	.....	.....	.....	.....
San Mateo—									
1910....	20,000	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**3,300**	.....	.....	.....	.....	.....	.....	.....	.....
Santa Clara—									
1911....	**5,280**	.....	.....	.....	.....	.....	.....	.....	.....
Santa Cruz—									
1910....	.....	.....	.....	.....	.....	14,500	.....	.....	.....
Progress	.....	.....	.....	.....	.....	.....	.....	1,320	.....
1911....	.....	.....	.....	.....	.....	**1,550**	.....	.....	.....
Selma—									
1910....	.....	.....	.....	.....	.....	.....	.....	18,800	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**3,000**	.....
S. Pasadena—									
1910....	.....	.....	.....	.....	.....	.....	.....	26,400	.....
Progress	.....	.....	.....	.....	.....	.....	.....	5,280	.....
1911....	**5,280**	.....	.....	.....	.....	.....	.....	.....	.....
Visalia—									
1910....	.....	.....	.....	.....	.....	.....	.....	3,960	.....
Progress	.....	.....	.....	.....	.....	.....	.....	5.530	.....
Watsonville—									
1910....	.....	.....	.....	.....	.....	2,600	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**5,200**	.....	.....	.....
CONNECTICUT.									
Ansonia—									
1910....	.....	.....	.....	240	.....	5.500	.....	.....	.....
1911....	.....	.....	.....	**1,000**	.....	**5,280**	.....	.....	.....
Hartford—									
1910....	2,640	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**2,640**	.....	.....	.....	.....	.....	.....	.....	.....
Meriden—									Gravel
1910....	.....	.....	.....	.....	.....	520	.....	.....	15,800
New Britain—									Indefinite
1910....	.....	6,900	.....	.....	.....	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**5,400**
New Haven—									
1910....	.....	.....	.....	820	2,640	10,100	8,300	6,300	.....
Torrington—									
1910....	.....	.....	.....	2,914	.....	14,173	3,202	520	.....
1911....	.....	.....	.....	**2,914**	.....	.....	.....	**1,200**	.....
Wallingford—									
1910....	.....	.....	.....	.....	.....	.....	.....	3,000	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**3,000**	.....
DISTRICT OF COLUMBIA.									
Washington—									
$60,000 work in progress.									
$79,500 work to be done.									
FLORIDA.									
Miami—									
1910....	.....	.....	.....	.....	.....	99,000	.....	.....	.....
Pensacola—									Unsettled
1910	.....	.....	24,000	.....	24,000	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**48,000**
GEORGIA.									
Americus—									
1910....	.....	.....	2,500	.....	2,000	.....	.....	.....	.....
Atlanta—									
1910....	.....	10,560	.....	5,280	11,035	36,960	.....	.....	.....
1910....	.....	**10,560**	.....	.....	**1,320**	**52,800**	.....	.....	.....
Brunswick—									
1910....	.....	.....	4,500	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**2,100**	.....	.....	.....	.....	.....	.....
Valdosta—									Gravel
Progress	.....	.....	.....	.....	.....	.....	.....	.....	180,000
IDAHO.									
Payette—									
1911....	.....	.....	.....	.....	.....	**5,280**	.....	.....	.....

ILLINOIS.

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Aurora—									
1910....	23,000	.....	1,850	.....	.....	.....	.....	.....	.....
1911....	**18,450**	.....	**5,280**	.....	.....	.....	.....	.....	.....
Canton—									
1910....	.....	.....	4,000	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**6,000**	.....	.....	.....	.....	.....	.....
Chicago Heights—									
1910....	.....	.....	2,640	.....	.....	5,280	.....	2,640	.....
Progress	.....	.....	5,280	.....	.....	7,920	.....	.....	.....
1911....	.....	.....	**15,840**	.....	.....	**13,200**	.....	**10,560**	.....
Collinsville—									
1910....	.....	.....	2,800	.....	.....	.....	.....	3,690	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**6,600**	.....
Danville—									
Progress	.....	.....	5,280	.....	1,320	.....	.....	2,640	.....
1911....	.....	.....	**15,800**	.....	.....	.....	.....	**5,280**	.....
Decatur—									
1910....	.....	.....	15,840	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**7,920**	.....	.....	.....	.....	.....	.....
Downers' Grove—									
1910....	.....	.....	2,640	.....	.....	.....	.....	.....	.....
E. St. Louis—									
1910....	.....	.....	21,100	.....	.....	.....	.....	.....	.....
Progress	.....	.....	10,650	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**64,500**	.....	.....	.....	.....	.....	.....
Edwardsville—									
1910....	.....	.....	4,820	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**5,280**	.....	.....	.....	.....	.....	.....
Elgin—									
1910....	.....	.....	6,700	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**6,894**	.....	.....	.....	.....	.....	.....
Eureka—									
1910....	.....	.....	7,920	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**2,640**	.....	.....	.....	.....	.....	.....
Freeport—									
1910....	.....	.....	7,900	.....	.....	3,960	.....	.....	.....
1911....	.....	.....	**10,650**	.....	.....	.....	.....	.....	.....
Galena—									
1910....	.....	.....	300	.....	.....	26,400	.....	.....	.....
Galesburg—									
1910....	.....	.....	3,900	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**3,500**	.....	.....	.....	.....	.....	.....
Granite City—									
1910....	.....	.....	2,400	.....	5,100	.....	.....	.....	.....
1911....	.....	.....	**3,500**	.....	.....	.....	.....	.....	.....
Harvey—									
1910....	.....	.....	8,400	.....	.....	1,540	.....	.....	.....
1911....	.....	.....	**5,700**	.....	.....	.....	.....	.....	.....
Jacksonville—									
1911....	**13,200**	.....	.....	.....	.....	.....	.....	.....	.....
Joliet—									Undetermined
1910....	.....	.....	2,100	.....	.....	1,100	.....	.....	4,000
Progress	.....	.....	350	.....	.....	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**2,700**	.....	.....	**3,000**
LaGrange—									
Progress	.....	2,640	.....	.....	.....	.....	.....	.....	.....
Lake Forest—									
1911....	.....	.....	.....	.....	.....	**10,560**	.....	.....	.....
Mattoon—									
1911....	.....	.....	**10,560**	.....	.....	.....	.....	.....	.....
Moline—									
1910....	.....	.....	9,000	.....	.....	.....	.....	.....	.....
Progress	.....	.....	4,750	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**25,350**	.....	.....	.....	.....	.....	.....
Mt. Carmel—									
1911....	.....	.....	**5,280**	.....	.....	.....	.....	.....	.....
Oak Park—									
1910....	5,400	.....	10,500	.....	.....	4,500	.....	.....	.....
Progress	.....	.....	7,920	.....	7,920	2,640	.....	9,200	.....
1911....	.....	.....	.....	.....	.....	**2,640**	.....	**7,920**	.....
Ottawa—									
1910....	.....	.....	5,280	.....	.....	.....	.....	.....	.....
Progress	.....	.....	3,980	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**17,150**	.....	.....	.....	.....	.....	.....
Paris—									Gravel
1910....	.....	.....	460	.....	.....	.....	.....	.....	4,000
1911....	.....	.....	**1,350**	.....	.....	.....	.....	.....	.....
Paxton—									
1910....	.....	.....	.....	.....	.....	2,640	.....	.....	.....
Peoria—									
1910....	16,232	.....	60,000	.....	6,666	1,818	.....	.....	.....
1911....	**22,722**	.....	**60,000**	.....	**3,000**	.....	.....	.....	.....
Rockford—									
1910....	.....	.....	.....	.....	.....	11,110	.....	.....	.....
1911....	.....	.....	**2,100**	.....	**450**	**10,000**	.....	.....	.....

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Rock Island—									
1910....			2,143						
Progress			5,280						
1911....	**700**		**1,200**						
Streator—									
1910....			13,240						
1911....			**5,280**						
Taylorville—									
1910....			29,000						
Waukegan—									
1910....			10,800			1,988		950	
Progress						355			
1911....								**10,500**	
Wheaton—									
1910....								7,920	
INDIANA.									
Anderson—									
1910....			9,800				160		
Auburn—									
1910....	14,700								
1911....			**300**						
Butler—									Gravel
1910....			10,560						
1911....									**700**
Columbus—									
1910....			1,620						
1911....			**25,100**						
Converse—									Gravel
1910....			2,640						21,100
Crawfordsville—									
1910....			5,400						
1911....			**4,000**						
E. Chicago—									
1910....	1,500		10,000						
Progress	5,800		6,550		1,250				
Evansville—									Undetermined
1910....	7,958		6,935						
1911....									**14,000**
Ft. Wayne—								Asphalt	Block
1910....	17,000		7,400			1,500			4,250
Progress			1,900			7,650			
									Undetermined
1911....									35,000
Hammond—									
1910....			3,590			1,220		15,670	
Huntington—									
1910....	2,029							2,600	
1911....	**3,000**							**4,000**	
Indianapolis—									Gravel
1910....	10,243	1,298	10,349		609			781	10,560
Progress	15,840								
Kokomo—									
1910....	4,200		5,200						
1911....	**2,500**		**6,500**			**2,500**			
Lebanon—									Gravel
Progress			966						
1911....			**966**						**2,640**
Logansport—									Gravel
1910....									3,000
Progress	7,700	1,500							
1911....	**8,000**	**1,400**							
Marion—									
1910....			2,140			2,100			
Martinsville—									
1911....			**10,560**						
Michigan City—									
1910....			2,300						
Mishawaka—									
1910....		2,700							
Muncie—									
1910....			6,600			5,280			
1911....			**10,560**			**17,200**			
Newcastle—									Gravel
1910....		1,380	760			2,920			1,818
Progress			1,006			1,030			1,093
1911....			**2,730**						
Peru—									Gravel
1910....		2,640	1,760						
1911....			**2,640**			**2,640**			**4,230**
Remington—									
1910....						31,600			
1911....						**52,800**			
Richmond—									Gravel
1910....			1,110			4,750			1,790
1911....			**3,920**			**15,700**			

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Rushville—									
1910			5,280						
1911			**10,560**						
South Bend—									
1910	3,520		9,908					8,351	
Veedersburg—									Gravel
1910			400						2,500
1911			**2,000**			**15,840**			
Wabash—									
1910									1,640
1911									**3,000**
Warsaw—									
1910	7,920								
Progress	10,560								
1911	**5,280**								

IOWA.

Albia—									
1910			2,700						
Ames—									
1910		2,400	400		7,200				
Belle Plaine—									Undetermined
1911									**9,600**
Burlington—									
1910			7,141					1,800	
Carroll—									
1911			**4,500**						
Centerville—									
1910			8,000						
Progress			1,000						
Charles City—									
1911			**7,900**						
Clinton—									
1910			600		1,500	800			
1911			**3,000**		**2,000**				
Corning—									
Progress			3,600						
Creston—									
1910								7,550	
Des Moines—									
1910	29,800		26,900		4,850		230		
1911*									
Eldora—									
1910							400		
Progress							4,400		
1911							3,200		
Ft. Dodge—									
1910	36,900						7,920		
1911	**10,560**								
Glenwood—									
1910			3,200				1,800		
Grinnell—									
1910		26,400							
Indianola—									
1911				**5,100**					
Knoxville—									
1910							3,000		
1911							**3,000**		
Mason City—									
1910			1,700				6,500		
Progress							4,000		
1911							**10,400**		
Osceola—									
1910			4,000						
Osage—									
1910							4,000		
Pella—									
1911			**7,920**						

*Probable increase in 1911 over 1910.

Red Oak									Undetermined
1911									**9,000**
Villisca—									
1911			**5,100**						
Washington—									
1910			3,500						
Waterloo—									
1910	19,000								
1911	8,000								

KANSAS.

Abilene—									
1910								8,000	
Argentine (now Ward 7, Kansas City, Kas.)—									
1910	2,640	2,640	2,640						
1911			**3,960**						

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Arkansas City—									
1910			3,800		10,600				
Progress					5,280				
1911	**2,640**		**10,600**		**15,900**		**1,220**		
Chanute—									
1910			7,920					2,640	
Progress			2,640						
1911								**7,920**	
Cherryvale—									
1910			4,300						
Emporia—									
1910	9,250								
1911	**10,560**								
Hutchinson—									
1910			12,000						
1911				**900**			**1,800**		
Lawrence—									
1910			15,840						
1911			**10,560**						
Manhattan—									
1911									Undetermined **6,900**
McPherson—									
1911									Undetermined **6,000**
Newton—									
1910			1,200						
1911			2,000						
Olathe—									
1910			1,900						
Pittsburg—									
1910			6,021						
Progress			1,787						
1911			**10,480**						
Salina—									
1910			5,280					7,920	
1911									**5,280**
Topeka—									
1911	**7,492**		**15,608**						
Wellington—									
1910	10,560								

KENTUCKY.

Ashland—									
1910		10,400	9,300						
1911			**6,600**						
Louisville—									
1910	25,200		23,300	2,590	1,380				
1911	**27,700**		**25,100**	**1,056**					
Maysville—									
1910			2,100			1,320			
1910			**2,100**						
Newport—									
1911			**18,000**						
Owensboro—									
1910						4,800			
1911						**3,500**			
Pineville—									
1911						5,280			
Winchester—									
1911			**4,000**						

LOUISIANA.

New Orleans—								Gravel and chert	
1910	70,110	20,300		39,350	500			*13,250	5,950
Progress	14,240	9,695		15,300				*1,600	
1911							**750**		

*Mineral rubber.

MAINE.

Lewiston—									Gravel
1910								3,780	13,200
1911								**3,780**	**13,200**

MARYLAND.

Annapolis—									
1910			8,200					1,860	

MASSACHUSETTS.

Easthampton—									Gravel
1910						1,100			2,300
1911						**3,000**			
Everett—									
1910			230	1,250		6,400			
Greenfield—									Gravel
1910						8,500		4,400	4,200
1911						**10,000**		**5,000**	
Lawrence—									
1910				15,588					

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Lowell—									Gravel
1910				1,450		10,000			2,640
Medford—									
1910						17,300		650	
New Bedford—									
1910		3,707		4,160		38,898			
1911				**5,000**		**36,000**			
Quincy—									
1910				4,019		4,699			
Progress						10,560			
Webster—									
1910						5,280			
MICHIGAN.									
Alpena—									
1910							1,100		
Battle Creek—									
1910			6,600						
1911			**5,280**						
Benton Harbor—									
1910			2,500			870			
1911			**1,000**			**360**			
Bessemer—									
1910						1,000			
Cadillac—									
1910		600				3,300			1,200
1911						**9,200**			
Flint—									Undetermined
1910	4,900		15,000						
1911						**8,000**			**8,800**
Gladwin—									
1910						3,000			
1911						**3,000**			
Grand Rapids—									
1910	3,504	12,029	13,120					1,047	21,093
Progress		697							17,156
Greenville—									
1910			2,300						
1911			**4,000**						
Highland Park—									
1910	3,500				10,560		1,780		
Progress	1,780								
Jackson—									Gravel
1910	2,640		2,640						
1911			**7,920**						**10,560**
Kalamazoo—									
1910	2,042		3,067						
Lansing—									
1910			1,500						
Manistique—									
1910						5,280			
Nestaunee—									
1911					**11,000**				
Norway—									
1911								**2,000**	
Port Huron—									
1910			1,500						
Saginaw—									
1910	6,700		7,900						
1911	**14,500**								
Sault Ste. Marie—									
1910						4,340		1,525	
Whitehall—									Gravel
1910						1,800			3,960
1911						**3,960**			
Wyandotte—									
1911			**3,000**						
MINNESOTA.									
Bemidji—									
1910							800		
1911							**1,600**		
Cloquet—									
1910						2,640			
1911						**5,280**			
Crookston—									
1911	**3,600**							**3,600**	
Faribault—									Sandstone
1910			3,466		84				611
Markato—									
1910			6,300						
1911			**6,000**						
New Ulm—									Gravel
1910									2,640
Progress									1,320
1911									2,640

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Redwing—									Sandstone
1910....	.....	.....	1,000	.....	1,320	.....	.....	.....	550
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**5,280**
St. Cloud—									
1910....	.....	.....	.....	.....	.....	.....	.....	2,640	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**1,500**	.....
St. Paul—									Sandstone
1910....	11,669	.....	2,218	.....	.....	23,602	.....	.....	2,165
Two Harbors—									Gravel
1910....	.....	.....	.....	.....	.....	2,820	.....	.....	10,750
Virginia—									Undetermined
1910....	.....	9,200	.....	.....	10,560	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**23,700**
Winona—									
1910....	.....	.....	995	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**2,800**	.....	.....	.....	.....	.....	.....
MISSISSIPPI.									
Hattiesburg—									
1910....	.....	.....	.....	.....	.....	7,920	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**10,560**	.....	.....	.....
Yazoo City—									Gravel
1910....	.....	.....	.....	.....	.....	.....	.....	.....	4,000
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**2,900**
MISSOURI.									
Aurora—									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**200**
Brooksfield—									
1910....	.....	.....	6,900	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**6,600**	.....	.....	.....	.....	.....	.....
Cape Girardeau—									
1910....	.....	.....	1,800	.....	180	6,000	.....	.....	.....
1911....	.....	.....	**1,400**	.....	.....	.....	.....	.....	.....
Clinton—									
1911....	.....	**27,300**	.....	.....	.....	.....	.....	.....	.....
Fulton—									
1910....	.....	.....	.....	.....	.....	243	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**5,000**	.....	.....	.....
Independence—									
1910....	.....	.....	.....	.....	.....	.....	12,400	.....	.....
1911....	.....	**2,400**	.....	.....	.....	.....	**9,000**	.....	.....
Kansas City—									
1910....	73,967	.....	3,937	6,292	1,355	19,604	.....	.....	.....
Lexington—									
1910....	.....	.....	760	.....	.....	.....	2,640	.....	.....
Libertyville—									
1910....	.....	.....	3,000	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**9,000**	.....	.....	.....	.....	.....	.....
Moberly—									
1910....	.....	.....	7,960	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**5,280**	.....	.....	.....	.....	.....	.....
Oregon—									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**2,640**
St. Joseph—									Sandstone
1910....	6,235	.....	6,543	.....	.....	161	22,536	.....	665
Progress	2,971	.....	.....	.....	.....	.....	2,227	.....	.....
1911....	**4,974**	.....	**557**	.....	.....	.....	**1,208**	.....	.....
Sedalia—									
1910....	.....	.....	6,300	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**10,800**	.....	.....	**3,960**	.....	.....	.....
Tarkio—									
1911....	.....	.....	.....	.....	.....	.....	**2,400**	.....	.....
Webb City—									Gravel
1910....	.....	.....	350	.....	.....	.....	.....	8,287	5,387
1911....	.....	.....	**500**	.....	.....	.....	.....	**5,500**	.....
MONTANA.									
Billings—									
1910....	.....	.....	9,750	.....	11,000	.....	1,100	.....	.....
1911....	.....	.....	.....	.....	**3,000**	.....	.....	.....	.....
Bozeman—									
1910....	.....	.....	.....	.....	.....	.....	1,000	.....	.....
Butte—									
1910....	.....	.....	850	220	.....	.....	.....	.....	.....
1911....	.....	.....	**1,200**	.....	.....	.....	.....	.....	.....
Great Falls—									
1910....	.....	.....	.....	.....	5,700	.....	3,000	.....	.....
1911....	.....	.....	.....	.....	**7,500**	.....	.....	.....	.....
Helena—									
1910....	.....	.....	550	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**1,000**	.....	.....	.....	**1,200**	.....	.....
NEBRASKA.									
Hastings—									
1910....	.....	.....	5,280	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**15,840**	.....	.....	.....	.....	.....	.....

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Lincoln—									
1910....	7,910	.....	3,232	.....	.....	.....	.....	.....	.....
1911....	**8,000**	.....	**3,000**	.....	.....	.....	.....	.....	.....
Norfolk—									Undetermined
1910....	.....	.....	6,900	.....	.....	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**15,000**
Seward—									
1910....	.....	.....	9,000	.....	.....	.....	.....	.....	.....
S. Omaha—									
1910....	6,100	12,000	4,600	.....	4,400	.....	.....	.....	.....
Progress	.....	.....	3,600	.....	.....	.....	.....	.....	.....
1911....	.....	**20,400**	**24,700**	.....	.....	.....	**5,000**	.....	.....
University Place—									
1911....	.....	.....	**1,600**	.....	.....	.....	.....	.....	.....
NEVADA.									
Reno—									
1910....	5,360	.....	.....	.....	.....	6,000	.....	6,900	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**10,560**	.....
NEW HAMPSHIRE.									
Keene—									
1910....	.....	.....	2,000	.....	.....	2,400	.....	.....	.....
Littleton—									
1910....	.....	.....	.....	.....	.....	800	.....	.....	.....
NEW JERSEY.									
Bayonne—									
1910....	10,560	3,800	2,500	.....	.....	.....	.....	.....	.....
Progress	3,000	.....	3,200	.....	.....	.....	.....	.....	.....
Beach Haven—									Gravel
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**105,600**
Bloomfield—									
1910....	.....	.....	.....	.....	.....	4,300	.....	.....	.....
1911....	.....	.....	.....	**2,640**	.....	**10,560**	.....	.....	.....
Dover—									
1911....	.....	.....	**1,500**	.....	.....	.....	.....	.....	.....
Elizabeth—									Sandstone
1910....	.....	.....	5,000	.....	.....	.....	.....	.....	6,065
Progress	.....	.....	1,236	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**1,537**	.....	.....	.....	.....	.....	.....
Garfield—									
1910....	.....	.....	.....	.....	.....	5,280	.....	.....	.....
Irvington—									
1910....	.....	.....	1,650	.....	.....	.....	.....	1,800	.....
Progress	.....	.....	750	.....	.....	.....	.....	3,900	.....
Jersey City—									
1910....	3,200	.....	2,000	16,400	1,400	2,000	.....	.....	.....
Progress	1,000	.....	3,800	9,900	2,640	3,700	.....	.....	.....
Millville—									Gravel
1910....	.....	.....	.....	.....	.....	.....	.....	.....	5,280
									Undetermined
Nutley—									
1910....	.....	.....	.....	.....	.....	10,560	.....	.....	.....
Ocean City—									Gravel
1910....	.....	.....	.....	.....	.....	5,280	.....	.....	21,120
1911....	.....	.....	.....	.....	.....	**15,840**	.....	.....	.....
Passaic—									Gravel
Progress	.....	.....	2,400	.....	.....	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**2,800**
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**7,000**
Plainfield—									
1910....	.....	.....	.....	.....	.....	7,100	.....	.....	.....
Progress	.....	.....	.....	.....	.....	10,600	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**5,000**	.....	.....	.....
Rahway—									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**1,680**
Rutherford—									
1910....	.....	.....	.....	.....	.....	6,850	.....	2,640	.....
1911....	.....	.....	.....	.....	.....	**7,920**	.....	**5,280**	.....
Westfield—									
1910....	.....	.....	.....	.....	.....	10,560	.....	1,320	.....
Progress	.....	.....	.....	.....	.....	.....	.....	5,280	.....
1911....	.....	.....	.....	.....	.....	**5,280**	.....	.....	.....
NEW YORK.									
Amsterdam—									
1910....	.....	.....	2,465	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**2,100**	.....	.....	.....	.....	.....	.....
Binghamton—									
1910....	.....	.....	7,400	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**9,600**	.....	.....	.....	.....	.....	.....
Brockport—									Gravel
1910....	.....	.....	.....	.....	.....	.....	.....	.....	2,100

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Buffalo—									Stone
1910....	62,256	.....	17,888	.....	.....	1,734	.....	.....	14,923
									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**63,360**
Catskill—									
1910....	.....	1,500	2,100	.....	.....	.....	.....	.....	.....
Corning—									
1910....	.....	.....	2,750	.....	.....	.....	.....	.....	2,750
1911....	.....	.....	**2,960**	.....	.....	.....	.....	.....	.....
Dunkirk—									
1910....	5,500	.....	3,600	.....	.....	.....	.....	.....	.....
1911....	**7,500**	.....	**7,500**	.....	.....	.....	.....	.....	.....
Elmira—									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**2,000**
Frankfort—									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**3,960**
Herkimer—									
1910....	.....	1,170	520	.....	.....	.....	.....	.....	.....
Hoosick Falls—									
1910....	.....	.....	5,280	500	.....	.....	.....	7,920	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**3,500**	.....
Jamestown—									
1910....	.....	.....	900	.....	.....	.....	.....	.....	.....
Kingston—									
1910....	.....	.....	7,500	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**3,000**	**3,500**	.....	**1,200**	.....	.....	.....
Little Falls—									
1910....	.....	2,500	.....	.....	.....	2,000	.....	.....	.....
1911....	.....	**4,000**	.....	.....	.....	**4,000**	.....	.....	.....
Middletown—									Gravel
1910....	.....	.....	4,500	.....	.....	.....	.....	.....	26,400
New York City (Borough of Brooklyn)—									Iron Slag
1910....	243,550	.....	.....	39,500	.....	42,400	.....	.....	3,000
Progress	5,500	.....	.....	11,690	.....	.....	.....	.....	.....
1911....	**82,200**	.....	.....	**19,800**	**4,200**	.....	.....	.....	.....
New York City (Borough of The Bronx)—									
1910....	37,018	.....	.....	5,760	.....	.....	.....	.....	.....
Progress	15,840	.....	.....	15,840	.....	.....	.....	.....	.....
New York City (Borough of Manhattan)—									
1910....	85,100	.....	.....	36,700	18,700	.....	.....	.....	.....
Progress	210	.....	.....	3,520	.....	.....	.....	.....	.....
Niagara Falls—									Undetermined
1910....	5,725	3,576	.....	372	.....	.....	3,577	.....	.....
Progress	7,870	.....	.....	.....	.....	.....	6,870	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**8,300**
Norwich—									
Progress	.....	.....	.....	.....	.....	.....	.....	2,600	.....
1911....	.....	.....	.....	800	.....	.....	.....	.....	.....
Ogdensburg—									
1910....	.....	.....	.....	.....	.....	900	.....	.....	.....
Olean—									Gravel
1910....	.....	.....	5,280	.....	.....	.....	.....	.....	10,560
Progress	.....	.....	1,320	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**15,840**	.....	.....	.....	.....	.....	.....
Oneida—									
1910....	.....	.....	410	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**1,600**	.....	.....	.....	.....	.....	.....
Plattsburg—									
1910....	.....	.....	.....	.....	.....	.....	2,900	.....	.....
1911....	.....	.....	.....	.....	.....	.....	**1,000**	.....	.....
Salamanca—									
1910....	.....	.....	3,700	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**2,640**	.....	.....	.....	.....	.....	.....
Solvay—									
1910....	.....	.....	.....	.....	.....	31,700	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**21,100**	.....	.....	.....
Syracuse—									Undetermined
1910....	12,600	.....	17,900	.....	.....	.....	.....	.....	.....
Progress	1,226	.....	1,983	.....	.....	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**12,000**
Troy—									
1910....	22,600	.....	10,000	85,500	.....	23,200	.....	.....	.....
Utica—									
1910....	15,700	.....	320	.....	.....	.....	.....	.....	.....
Progress	.....	.....	.....	.....	.....	5,280	.....	.....	.....
Watertown—									
1910....	.....	.....	.....	.....	2,640	23,760	.....	2,640	.....
1911....	.....	**2,640**	**5,280**	.....	**2,640**	**21,120**	.....	**2,640**	.....

NORTH CAROLINA.

Asheville—									
1910....	.....	17,535	.....	.....	.....	4,584	.....	.....	.....
1911....	.....	**4,000**	.....	.....	.....	.....	.....	.....	.....
Greenville—									Sand-Clay
1910....	.....	.....	3,500	.....	.....	.....	.....	.....	10,560

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Hendersonville—									Gravel
Progress									52,800
1911		**10,560**							
Raleigh—									
1910	5,400							1,000	
1911								**5,280**	
Wilson—									
1910						5,000			

NORTH DAKOTA.

Grand Forks—									Undetermined
1910		5,950			5,280		*17,800		
1911									**21,000**

*Blome concrete and tar macadam.

Minot—									Gravel
1910									7,940
Progress									5,280
1911									**15,800**

OHIO.

Akron—									Medina
1910			45,000						2,600
Progress			4,200				1,180		
1911			**42,000**						
Alliance—									
1910			11,200						
Progress			5,300						
Ashtabula—									Stone
1910			4,232						
Progress			1,436						
1911			**7,215**						**1,458**
Bellefontaine—									
1910			5,280			2,640			
1911			**2,640**						
Bowling Green—									
Progress						1,500			
1911						**5,000**			
Bucyrus—									
1910			10,638				1,115		
1911			**1,100**						
Canal Dover—									Undetermined
1911									**10,560**
Canton—									
1910			5,828						
Progress			1,718						
1911			**4,000**						
Carrolton—									
1910			8,540						
Progress			1,580						
1911			**7,500**						
Celina—									
1910			1,500			21,100			
Cincinnati—									Cobble
1910	2,200		16,470	29,570	13,560	13,500	500		1,000
Progress		5,000	650	25,000	15,000	5,000			
Cleveland Heights—									
1910						15,800			
1911	**10,560**		**10,560**			**10,560**			
Columbus—									
1910	9,500		54,500			2,270			
Progress	10,300		34,000						
1911	**10,560**		**79,200**			**5,280**			
Coshocton—									
1910			3,000						
1911	**3,400**								
Delaware—									
1910			2,250						
Progress			1,100						
1911			**1,100**			**500**			
E. Cleveland—									
1910			1,320			3,960			
1911			**18,480**						
E. Liverpool—									
1910			12,100						
1911			**9,500**						
Euclid—									
1910						2,640			
1911			**1,320**						
Findlay—									
1911			**750**						
Fostoria—									
1910			5,854						
1911			**2,680**						
Galion—									
1911			**12,000**					**3,000**	

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Greenville—									
1910			1,400						
Progress			2,640						
1911						**300**			
Ironton—									
1910			1,920						
1911			**3,800**						
Lancaster—									
1910			6,100						
Leetonia—									
1910			2,817						
Lorain—									
1910								4,000	
Progress								9,580	
1911			**540**						
Marietta—									
1910			10,416						
Progress			2,300						
Massillon—									
1911			**7,500**						
Miamisburg—									Gravel
1910									5,280
Millersburg—									
1911								**1,320**	
Nelsonville—									
1910			5,700			17,200			
New Lexington—									
1910			4,165						
1911			**3,065**						
Niles—									
1911			**400**						
Norwalk—									
1910			2,970					1,350	
Progress			1,000					900	
Norwood—									
1910						18,500			
1911	**1,000**			**2,640**	**2,640**	**15,800**			
Oberlin—									
1910			390			600			
1911						**600**			
Pomeroy—									
1911			**5,940**						
Ravenna—									
1910			3,500						
Progress			3,600						
1911			**700**						
Steubenville—									Ligonier
1910			13,200						2,640
Progress			5,280						
1911			**15,840**						
Toledo—									Undetermined
1910	8,030		22,620			4,700			
Progress		7,920							
1911									**26,400**
Wadsworth—									
1910			26,025						
1911			**2,915**						
Wauseon—									
1910	1,300								
1911								**7,920**	
Youngstown—									Undetermined
1911									**10,560**
Zanesville—									
1910			1,250						
1911			**9,000**						
OKLAHOMA.									
Bartlesville—									
1910		4,650	5,280						
Progress		1,500							
1911			**5,280**						
Chandler—									
1910								10,560	
Clinton—									
1911									**21,120**
Enid—									
1910	31,700								
El Reno—									
1911	**26,400**								
Guthrie—									
1910	31,600		3,960						
1911	**10,560**		**1,320**						
Lawton—									
1910	10,560								
1911	**39,500**								

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Muskogee—									
1910....	30,610	1,350	4,201	.....	.....	7,440	.....	.....	.....
Progress	9,020	.....	2,640	.....	.....	2,890	.....	.....	.....
1911....	**35,000**	**3,800**	**3,000**	.....	.....	**9,000**	.....	.....	.....
Norman—									
1910....	5,280	.....	1,600	.....	.....	.....	.....	.....	.....
1911....	**10,560**	.....	.....	.....	.....	.....	.....	.....	.....
Shawnee—									
1910....	52,800	.....	11,560	.....	.....	.....	.....	.....	.....
1911....	**26,400**	.....	.....	.....	.....	.....	.....	.....	.....
Tulsa—									
1910....	56,500	.....	4,800	.....	.....	.....	.....	.....	.....
1911....	**24,000**	.....	**6,300**	.....	.....	.....	.....	.....	.....
Vinita—									
1910....	.....	.....	4,700	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**6,000**	.....	.....	.....	.....	.....	.....
OREGON.									
Cloquille—									
1910....	.....	.....	.....	.....	2,000	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**7,920**	.....	.....	.....
Marshfield—									
1910....	.....	.....	.....	.....	21,100	.....	.....	.....	.....
Progress	.....	.....	.....	.....	2,640	.....	.....	.....	.....
1911....	**8,000**	.....	.....	.....	**5,280**	.....	.....	.....	.....
Portland—									Gravel
1910....	147,629	122,021	.....	8,554	.....	22,123	56,654	.....	15,312
The Dalles—									
1910....	.....	10,560	.....	.....	.....	.....	.....	.....	.....
1911....	.....	**10,560**	.....	.....	.....	.....	.....	.....	.....
PENNSYLVANIA.									
Bellefonte—									
1910....	.....	.....	810	.....	.....	.....	.....	1,900	.....
Progress	.....	.....	.....	.....	.....	.....	.....	4,252	.....
Bellwood—									
1910....	.....	.....	.....	.....	.....	2,400	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**2,400**	.....	.....	.....
Carbondale—									
1911....	.....	.....	**2,640**	.....	.....	**7,920**	.....	.....	.....
Chambersburg—									Red Shale
1910....	.....	.....	.....	.....	.....	5,817	.....	.....	300
Chester—									
1910....	51,600	.....	18,500	22,200	.....	17,200	.....	.....	.....
Progress	.....	.....	.....	.....	11,000	.....	.....	12,300	.....
Corry—									
1910....	.....	.....	2,269	.....	.....	.....	.....	.....	.....
Doyleston—									Cinder
1910....	.....	.....	.....	.....	.....	5,000	.....	.....	8,000
Progress	.....	.....	.....	.....	1,000	.....	.....	.....	.....
1911....	.....	.....	.....	.....	.....	**2,000**	.....	.....	.....
Erie*—									
1910....	16,900	.....	16,400	.....	.....	26,600	.....	.....	.....
1911....	.....	.....	**15,000**	.....	.....	.....	.....	.....	.....
*Cobble 6,300 ft., slag 16,600 ft. in 1910.									
Franklin—									
1911....	.....	.....	**7,940**	.....	.....	.....	.....	.....	.....
Gallitzin—									
1910....	.....	.....	3,700	.....	.....	.....	.....	.....	.....
Harrisburg—									
1910....	6,350	.....	.....	.....	.....	.....	.....	.....	.....
Progress	1,003	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**121,440**	.....	.....	.....	.....	.....	.....	.....	.....
Luzerne—									
1910....	.....	.....	1,700	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**1,600**	.....	.....	.....	.....	.....	.....
McKees Rock—									
1910....	.....	.....	4,800	.....	.....	.....	.....	.....	.....
Progress	.....	.....	2,700	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**10,000**	.....	.....	.....	.....	.....	.....
Minersville—									
1910....	.....	.....	2,676	.....	.....	.....	.....	.....	.....
Newcastle—									
1910....	.....	.....	6,600	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**10,560**	.....	.....	.....	.....	.....	.....
Norristown—									
1910....	.....	.....	.....	.....	.....	1,000	.....	.....	.....
1911....	.....	.....	**25,200**	.....	.....	.....	.....	.....	.....
Northeast—									
1910....	.....	.....	7,920	.....	.....	.....	.....	.....	.....
Northumberland—									
1911....	.....	.....	**1,360**	.....	.....	.....	.....	.....	.....
Oil City—									Undetermined
1910....	.....	.....	17,816	.....	.....	.....	.....	.....	.....
Progress	.....	.....	3,000	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**8,400**	.....	.....	.....	.....	.....	**1,500**

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others Undetermined
Port Allegany—									
1911									**21,100**
Pottsville—									
1910				2,030	4,650	6,000			
Reading—									
1910			3,290		300		4,200		
Progress			4,900	190					
Sharpsville—									
1911			**3,600**						
Somerset—									
1910			3,160						
Swissvale—									
1910			1,700						
Tyrone—									
1910			380		366				
Waynesboro—									
1910								1,500	
Wilkes-Barre—									
1910	3,090		2,730	350					
Wilkinsburg—									Ligonier
1910	2,640		124,040						10,560
Progress			1,320						
1911			**2,640**						
Williamsport—									
1910			2,100						
1911			**3,000**						
RHODE ISLAND.									
E. Providence—									
1911				**1,800**					
Pawtucket—									Gravel
1910						8,250		3,960	1,320
Providence—									Gravel
1910			160	2,420					15,300
Progress	320			1,000					
1911				**3,490**					**12,100**
Woonsocket—									
1910				350					
SOUTH CAROLINA.									
Chester—									
1910						3,000			
Florence—									
1911			**5,280**						
Greenville—									
1910	2,400		1,800		1,200			1,500	
Progress	1,200		11,700						
1911	**3,600**		**7,500**					**12,000**	
Union—									
1910						13,200			
Progress						2,640			
1911						**2,640**			
SOUTH DAKOTA.									
Lead—									
1910								400	
1911								**2,000**	
Mitchell—									Gravel
1910						2,640			5,280
Pierre—									Gravel
1910									7,920
Progress									2,640
1911									**5,280**
Rapid City—									
1910						5,280			
1911						**10,560**			
Sioux Falls—									
1910				1,042					
TENNESSEE.									
Columbia—									
1910						18,480			
1911						**5,280**			
Knoxville—									
1910						25,100			
1911									**18,000**
Memphis—									Gravel
1910	36,643	4,963	14,203				*9,240	51,955	46,675
Progress	19,744		4,753		2,323		7,603	20,255	528
1911	Not yet known.								
*Concrete, cobble and shell.									
Paris—									Gravel
1910									15,800
1911									**10,560**

TEXAS.

City	Asphalt	Bituthic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Denison—									
1910....	.....	.....	2,640	.....	.....	.....	.....	.....	.....
1911....	.....	.....	**3,960**	.....	.....	**42,300**	.....	.....	.....
El Paso—									
1910....	.....	.....	16,400	.....	.....	.....	.....	6,700	.....
1911....	.....	.....	**150,000**	.....	.....	.....	.....	.....	.....
Greenville—									
1911....	**31,700**	.....	.....	.....	.....	.....	.....	.....	.....
Texas City—									
Progress	.....	.....	.....	.....	.....	.....	.....	10,560	.....
1911....	.....	.....	.....	.....	.....	.....	.....	**37,000**	.....

UTAH.

Ogden—									
1910....	5,280	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**15,000**	.....	.....	.....	**600**	.....	.....	.....	.....
Salt Lake City—									
1910....	45,400	.....	.....	.....	.....	.....	.....	.....	.....
Progress	2,640	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**26,400**	.....	.....	.....	.....	.....	.....	.....	.....

VERMONT.

Barre—									
1910....	.....	.....	.....	.....	.....	4,811	.....	.....	.....
Bellows Falls—									Gravel
1910....	.....	.....	.....	.....	.....	.....	.....	.....	2,640
1911....	.....	.....	.....	**1,200**	.....	.....	.....	.....	.....
St. Albans—									Gravel
1910....	.....	.....	.....	.....	.....	7,650	.....	1,300	3,900

VIRGINIA.

Chatham—									
1911....	.....	.....	.....	.....	.....	**10,560**	.....	.....	.....
Danville—									Cobble
1910....	.....	5,500	9,900	.....	.....	12,400	.....	.....	39,600
Fredericksburg—									Undetermined
1911....	.....	.....	.....	.....	.....	.....	.....	.....	**300**
Richmond—									
1910....	$14,000 work being done.								
1911....	Prospects will not be known until the budget is approved and adopted by the Council.								

WASHINGTON.

Bellingham—									Gravel
1910....	7,565	.....	2,196	.....	3,297	.....	.....	.....	9,819
Progress	.....	.....	.....	.....	.....	.....	.....	.....	4,320
1911....	**1,100**	.....	.....	.....	**1,200**	.....	.....	.....	.....
Colfax—									Gravel
1911....	.....	.....	.....	.....	.....	**9,100**	.....	**4,300**	**3,200**
Everett—									
1910....	9,945	.....	2,280	.....	.....	.....	.....	.....	.....
Progress	4,320	.....	.....	.....	.....	.....	.....	.....	.....
1911....	**12,536**	.....	**2,612**	**380**	.....	.....	.....	.....	.....
Hoquiam—									Gravel
1910....	1,180	.....	3,800	.....	.....	.....	.....	.....	16,000
Progress	.....	.....	.....	.....	.....	.....	.....	.....	15,300
1911....	**5,800**	.....	.....	.....	.....	.....	.....	.....	**10,000**
Kent—									
1910....	.....	.....	.....	.....	.....	.....	5,280	.....	.....
1911....	**2,640**	.....	.....	.....	.....	.....	.....	.....	.....
Pullman—									
1910....	.....	.....	.....	.....	.....	.....	.....	5,280	.....
Seattle—									Sandstone
1910....	212,253	.....	32,200	5,000	260	.....	106	.....	12,200
S. Yakima—									
1910....	10,560	.....	1,200	.....	.....	.....	.....	.....	.....
Progress	.....	.....	1,200	.....	.....	.....	.....	.....	.....
1911....	**10,560**	.....	.....	.....	.....	.....	.....	.....	.....
Spokane—									
1910....	63,500	.....	16,700	5,900	.....	.....	9,200	12,210	.....
Progress	32,100	.....	21,600	12,600	.....	.....	5,280	12,080	.....
1911....	**52,800**	.....	**31,400**	**21,100**	.....	.....	**15,840**	**21,120**	.....
Tacoma—									Sandstone
1910....	76,560	.....	6,019	.....	14,837	528	1,795	.....	4,858
Progress	1,901	.....	317	.....	.....	.....	3,062	.....	2,798
Walla Walla—									
1910....	15,000	.....	.....	.....	.....	4,000	.....	.....	.....
1911....	**26,400**	.....	.....	.....	.....	.....	.....	.....	.....

WEST VIRGINIA.

Appleton—									
1910....	7,700	.....	.....	.....	.....	.....	5,750	.....	.....
1911....	**6,000**	.....	.....	.....	.....	.....	**900**	.....	.....
Charleston—									
1910....	.....	18,200	10,700	.....	.....	.....	.....	4,200	.....

City	Asphalt	Bitulithic	Brick	Granite	Wood	Macadam	Concrete	Bituminous	Others
Fairmont—									
1910			3,480						
1911			**1,740**						
Middlebourne—									
1911			**5,800**						
Wheeling—									Gravel
1910			13,000			1,000			1,000
Progress			1,000						
WISCONSIN.									
Beloit—									Gravel
1910			13,100						
1911			**6,000**						**3,000**
Berlin—									
1910						300			15,840
Burlington—									Gravel
1910			3,760						1,260
1911			**1,480**				**3,200**		
De Pere—									
1910							3,580		
Eau Claire—									
1910						1,600			
1911						**4,000**			
Fond du Lac—									
1910							14,772		
1911			**2,100**				**3,700**		
Hartford—									Gravel
1910									11,817
La Crosse—									
1910			366						
Manitowoc—									
1910			10,000						
Milwaukee—									Concrete
1910	28,420		25,160	4,197	9,070	34,470			
1911	**45,000**			**7,510**				**45,000**	**15,000**
Oshkosh—									Undetermined
1910	6,600		800		2,100	2,640	1,400		
1911									**8,000**
Portage—									
1910						5,280			
Watertown—									
1910			3,550						
1911			**1,900**						
Waupaca—									
1910						2,800			
1911						**3,960**			
Wausau—									
1910						71,500			
1911					**2,800**				
WYOMING.									
Laramie—									Gravel
1910									15,840
1911									**37,660**
CANADA.									
Kingston, Ont.—									
1911	**1,000**					**10,560**			
Toronto, Ont.—									
1910	62,830	32,000	1,100		500		5,700		
1911	Approximately same as 1910.								
Winnipeg, Man.—									
1910	48,700				5,600	3,300		1,330	

SIDEWALK IMPROVEMENTS

Official Reports of Sidewalk Improvements Made to Municipal Engineering by the Municial Officials of America

Arranged alphabetically by states and cities.

In the line "1910" under each city is given the number of linear feet of each class of sidewalk laid in the year 1910.

In the line "Progress" is given the number of linear feet of each class of sidewalk in process of construction.

In the line "1911" is given the number of linear feet of each class of sidewalk proposed for construction during 1911, printed in heavy type so that it can be distinguished readily.

The reports have been reduced to the same unit of linear feet. When the area of sidewalks was given in square feet or square yards it has been reduced to linear feet by assuming the average width of sidewalks as 5.5 feet.

The column headed "Cement" includes cement walks laid in place, concrete flags and concrete blocks.

ALABAMA.

Cities	Cement	Brick	Wood	Others
Birmingham—				
Progress.	7,500	.....	.....	.....
1911.....	**15,000**	.....	.....	.....
Dothan—				
1910.....	4,150	.....	.....	.....
Progress.	63,500	.....	.....	.....
1911.....	**63,500**	.....	.....	.....
Jasper—				Clay
1910.....	.....	.....	.....	10,560
1911.....	.....	.....	.....	**15,800**
New Decatur—				
1910.....	42,300	.....	.....	.....
Progress.	37,000	.....	.....	.....
1911.....	**26,300**	.....	.....	.....

ARKANSAS.

Batesville—				
1910.....	5,000	.....	.....	.....
Ft. Smith—				
1910.....	21,100	.....	.....	.....
1911.....	**31,400**	.....	.....	.....

CALIFORNIA.

Alhambra—				
1910.....	29,000	.....	.....	.....
Antioch—				
1910.....	2,000	.....	.....	.....
Coalinga—				
1910.....	31,400	.....	.....	.....
Progress.	5,280	.....	.....	.....
E. San Jose—				
1910.....	10,560	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Long Beach—				
1910.....	26,400	.....	.....	.....
Los Angeles—				
1910.....	161,000	.....	.....	.....
Oakland—				
1910.....	218,500	.....	.....	.....
Progress.	185,000	.....	.....	.....
1911.....	**158,000**	.....	.....	.....
Palo Alto—				
1910.....	5,007	.....	.....	.....
1911.....	**10,000**	.....	.....	.....
Pasadena—				
1910.....	101,500	.....	.....	.....
Progress.	5,280	.....	.....	.....
Portersville—				
1910.....	15,840	.....	.....	.....
Progress.	26,400	.....	.....	.....
San Bernardino—				
1910.....	26,400	.....	.....	.....
San Jose—				
1910.....	138,228	.....	.....	.....
San Mateo—				
1910.....	109,000	.....	.....	.....
1911.....	**18,200**	.....	.....	.....
Santa Cruz—				
1910.....	10,560	.....	.....	.....
Progress.	900	.....	.....	.....
Selma—				
1910.....	15,800	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
S. Pasadena—				
1910.....	5,280	.....	.....	.....
Visalia—				
1910.....	300	.....	.....	.....
1911.....	**6,500**	.....	.....	.....
Watsonville—				Bituminous
1910.....	10,900	.....	.....	4,880
1911.....	**10,000**	.....	.....	**5,000**

CONNECTICUT.

Ansonia—				
1910.....	1,000	.....	.....	.....
Bristol—				
1910.....	10,000	.....	.....	.....
Meriden—				*
1910.....	.....	.....	.....	53,828
*Bluestone and concrete.				
New Britain—				Bluestone
1910.....	18,500	.....	.....	3,300
1911.....	**15,800**	.....	.....	**3,960**
New Haven—				
1910.....	729,000	.....	.....	.....

Cities	Cement	Brick	Wood	Others
Torrington—				†
1910.....	.....	.....	.....	12,808
†Cement and tar.				
Wallingford—				
1911.....	**500**	.....	.....	.....

COLORADO.

Florence—				
1910.....	10,560	.....	.....	.....
1911.....	**69,000**	.....	.....	.....

FLORIDA.

Pensacola—				
1910.....	163,000	.....	.....	.....
1911.....	**238,000**	.....	.....	.....

GEORGIA.

Americus—				Art tile
1910.....	.....	.....	.....	5,600
Atlanta—				
1910.....	189,024†	.....	.....	.....
1911.....	**184,800**†	.....	.....	.....
† Cement and brick.				
Brunswick—				
1910.....	.....	.....	.....	15,640
1911.....	.....	.....	.....	**5,280***
* Eight-foot hexagon tile.				
Cordele—				Tile
1910.....	3,050	1,520	.....	5,250
Valdosta—				
1910.....	162,000	.....	.....	.....
1911.....	**45,000**	.....	.....	.....

IDAHO.

Payette—				
1910.....	7,920	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Pocatello—				
1910.....	36,700	.....	.....	.....

ILLINOIS.

Canton—				
1910.....	2,640	3,960	.....	.....
1911.....	**7,920**	**7,920**	.....	.....
Chicago Heights—				
1910.....	43,000	.....	.....	.....
Progress.	36,900	.....	.....	.....
1911.....	**26,300**	.....	.....	.....
Collinsville—				
1910.....	9,800	.....	.....	.....
1911.....	**4,550**	.....	.....	.....
Danville—				
1910.....	26,400	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Decatur—				
1910.....	42,300	.....	.....	.....
Dekalb—				
1910.....	5,280	.....	.....	.....
Downers Grove—				
1910.....	.....	2,640	.....	.....
Edwardsville—				
1910.....	8,000	.....	.....	.....
1911.....	**10,000**	.....	.....	.....
Elgin—				
1910.....	20,226	.....	.....	.....
Galena—				
1910.....	21,100	.....	.....	31,700
1911.....	**3,960**	.....	.....	.....
Granite City—				
1910.....	20,000	.....	.....	.....
Harvey—				Cinders
1910.....	12,880	.....	.....	2,000
Joliet—				
1910.....	31,700	.....	.....	.....
1911.....	**26,300**	.....	.....	.....
Lagrange—				
1910.....	2,640	.....	.....	.....
Lake Forest—				
1911.....	**5,000**	.....	.....	.....
Mattoon—				
1910.....	3,200	.....	.....	.....
Moline—				
1910.....	6,350	.....	.....	.....
Progress.	15,800	.....	.....	.....
Mt. Pulaski—				
1910.....	800	5,280	.....	.....
1911.....	**1,200**	**5,280**	.....	.....
Oak Park—				
1910.....	29,700	.....	.....	.....
Ottawa—				
1910.....	6,000	.....	.....	.....

Cities	Cement	Brick	Wood	Others
Paris—				
1910.....	13,200	.....	.....	.....
Paxton—				
1910.....	10,560	.....	.....	.....
1911	**5,280**	.....	.....	.....
Peoria—				
1910.....	105,600	.....	.....	.....
1911.....	**105,600**	.....	.....	.....
Petersburg—				
1910.....	1,600	.....	.....	.....
Rock Island—				
1911.....	**8,700**	.....	.....	.....
Streator—				
1910.....	5,280	10,560	.....	.....
Taylorville—				
1910.....	25,600	.....	.....	.....
1911.....	**43,200**	.....	.....	.....
Waukegan—				
1910.....	3,960	.....	.....	.....
Progress.	2,220	.....	.....	.....
Wheaton—				
1910.....	10,560	.....	.....	.....
1911.....	**10,560**	.....	.....	.....

INDIANA.

Anderson—				
1910.....	12,350	.....	.....	.....
Auburn—				
1910.....	.....	5,280	.....	.....
Brazil—				
1910.....	5,280	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Columbia City—				
1910.....	2,640	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Columbus—				
1910.....	2,640	.....	.....	.....
1911.....	**1,320**	.....	.....	.....
Converse—				
1910.....	26,400	.....	.....	.....
Crawfordsville—				
1910.....	5,000	.....	.....	.....
1911.....	**2,500**	.....	.....	.....
E. Chicago—				
1910.....	31,600	.....	.....	.....
1911.....	**110,100**	.....	.....	.....
Evansville—				
1910.....	23,000	5,280	.....	.....
1911.....	**23,000**	**5,280**	.....	.....
Ft. Wayne—				
1910.....	71,000	.....	.....	.....
Progress.	12,680	.....	.....	.....
1911.....	**35,400**	.....	.....	.....
Hammond—				
1910.....	.....	93,562	.....	.....
1910.....	15,134	.....	.....	.....
Huntington—				
1910.....	5,400	.....	.....	.....
Indianapolis—				
1910.....	93,562	.....	.....	.....
Kokomo—				
1910.....	21,300	.....	.....	.....
1911.....	**14,000**	.....	.....	.....
Lebanon—				
1910.....	1,320	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Logansport—				
1910.....	8,000	.....	.....	.....
1911.....	**3,000**	.....	.....	.....
Marion—				
1910.....	735	.....	.....	.....
Martinsville—				
1910.....	5,280	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Michigan City—				
1910.....	13,200	.....	.....	.....
Mishawaka—				
1910.....	35,200	.....	.....	.....
Muncie—				
1910.....	2,000	.....	.....	.....
1911.....	**600**	.....	.....	.....
New Castle—				
1910.....	15,909	.....	.....	.....
Progress.	4,958	.....	.....	.....
1911.....	**4,060**	.....	.....	.....
Peru—				
1910.....	5,280	.....	.....	.....
Progress.	8,400	.....	.....	.....
Richmond—				
1910.....	2,900	.....	.....	.....
1911.....	**37,000**	.....	.....	.....
Rushville—				
1910.....	5,000	.....	.....	.....
1911.....	**6,000**	.....	.....	.....
South Bend—				
1910.....	19,136	.....	.....	.....
Sullivan—				
1910.....	18,500	.....	.....	.....
1911.....	**7,920**	.....	.....	.....
Terre Haute—				
1910.....	69,000	.....	.....	.....
Veedersburg—				
1910.....	7,000	.....	.....	.....
1911.....	**6,000**	.....	.....	.....
Wabash—				
1910.....	12,224	.....	.....	.....
1911.....	**6,000**	.....	.....	.....
Warsaw—				
1910.....	2,640	.....	.....	.....
Wolcottville—				
1910.....	3,000	.....	.....	.....
1911.....	**1,500**	.....	.....	.....

KANSAS.

Abilene—				
Progress.	52,800	.....	.....	.....
1911.....	**105,600**	.....	.....	.....
Argentine—				
1910.....	2,640	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Arkansas City—				
1910.....	38,400	.....	.....	.....
1911.....	**45,500**	.....	.....	.....
Cherryvale—				
1910.....	.....	1,000	.....	.....
Clay Center—				
1910.....	3,000	.....	.....	.....
1911.....	**2,500**	.....	.....	.....
Emporia—				
1910.....	13,200	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Holton—				
1910.....	13,200	.....	.....	.....
Hutchinson—				
1910.....	25,000	1,000	.....	.....
1911.....	**25,000**	**1,000**	.....	.....
Lawrence—				
1910.....	15,800	5,280	.....	.....
Manhattan—				
1910.....	15,800	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Olathe—				
1910.....	3,000	.....	.....	.....
Pittsburg—				
1910.....	.....	2,685	.....	.....
Progress.	.....	3,178	.....	.....
Pratt—				
1910.....	10,560	.....	.....	.....
Salina—				
1910.....	2,640	5,280	.....	.....

KENTUCKY.

Ashland—				
1911.....	**21,100**	.....	.....	.....
Louisville—				
1910.....	11,070	6,180	.....	.....
1911.....	**12,500**	**2,500**	.....	.....
Maysville—				
1910.....	10,560	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Paducah—				
1910.....	110,900	.....	.....	.....
Pineville—				
1910.....	1,400	.....	.....	.....
1911.....	**200**	.....	.....	.....

IOWA.

Ames—				
1910.....	18,500	.....	.....	.....
Burlington—				
1910.....	26,400	.....	.....	.....
Cedar Falls—				
1910.....	26,400	.....	.....	.....
Centerville—				
1910.....	5,280	.....	.....	.....
1911.....	**5,280**	.....	.....	.....

Cities	Cement	Brick	Wood	Others
Charles City—				
1910	26,400	.....	.....	.....
Clinton—				
1910	63,400	.....	.....	.....
1911	**31,700**	.....	.....	.....
Creston—				
1910	3,900	.....	.....	.....
Progress.	1,800	.....	.....	.....
Des Moines—				
1910	5,400	7,150	.....	.....
1911	**5,900**	**7,900**	.....	.....
Eldora—				
1910	2,120	.....	.....	.....
1911	**3,000**	.....	.....	.....
Ft. Dodge—				
1910	15,800	.....	.....	.....
1911	**15,800**	.....	.....	.....
Glenwood—				
1910	800	.....	.....	.....
Grinnell—				
1910	.....	17,600	.....	.....
Independence—				
1910	12,375	.....	.....	.....
1911	**12,000**	.....	.....	.....
Indianola—				
1910	44,000	.....	.....	.....
1911	**5,280**	.....	.....	.....
Mason City—				
1910	21,100	.....	.....	.....
Newton—				
1910	5,000	.....	.....	.....
Pella—				
1910	13,200	.....	.....	.....
Washington—				
1910	1,000	.....	.....	.....
Waterloo—				
1910	21,600	.....	.....	.....

LOUISIANA.

Morgan City—				
1910	26,400	.....	.....	.....
1911	**10,560**	.....	.....	.....
New Orleans—				
1910	.....	23,548	.....	.....
Progress.	.....	4,500	.....	.....
Opelousas—				
1910	2,260	.....	.....	.....
1911	**23,500**	.....	.....	.....

MAINE.

Lewiston—				
1910	2,500	6,000	.....	.....
1911	**2,500**	**6,000**	.....	.....

MASSACHUSETTS.

Easthampton—				Tar
1910	.....	.....	.....	2,000
1911	.....	.....	.....	**2,000**
Everett—				Tar concrete
1910	8,800	1,050	.....	1,800
Greenfield—				Tar
1910	5,600	.....	.....	3,500
1911	**5,000**	.....	.....	**2,000**
Lawrence—				Tar concrete
1910	5,741	.....	.....	29,986
Lowell—				*
1910	548	.....	.....	.....
Medford—				Tar
1910	890	690	.....	280
New Bedford—				
1910	13,476	.....	.....	.....
1911	**14,000**	.....	.....	.....
Quincy—				Tar
1910	2,640	.....	.....	15,840

* Tar concrete, 2,387 feet; cinders, 12,071.

Webster—				
1910	4,000	.....	.....	.....

MICHIGAN.

Alpena—				
1910	10,560	.....	.....	.....
Battle Creek—				
1910	85,000	.....	.....	.....
1911	**7,300**	.....	.....	.....
Benton Harbor—				
1910	4,000	.....	.....	.....
1911	**3,000**	.....	.....	.....
Bessemer—				
1910	2,860	.....	.....	.....
Cadillac—				
1910	9,100	.....	.....	.....
1911	**4,360**	.....	.....	.....
Flint—				
1910	48,200	.....	.....	.....
Gladwin—				
1910	5,000	.....	.....	.....
1911	**5,000**	.....	.....	.....
Grand Rapids—				
1910	49,750	.....	.....	.....
Hancock—				
1910	23,100	.....	.....	.....
Highland Park—				
1910	16,400	.....	.....	.....
Jackson—				
1910	13,200	.....	.....	.....
1911	**18,500**	.....	.....	.....
Kalamazoo—				
1910	14,142	.....	.....	.....
1911	**15,000**	.....	.....	.....
Lake City—				
1910	1,000	.....	.....	.....
Manistique—				
1910	6,876	.....	.....	.....
Marine City—				
1910	5,488	3,400	.....	.....
1911	**450**	.....	.....	.....
Negaunee—				
1910	45,000	.....	.....	.....
Fort Huron—				
1910	10,560	.....	.....	.....
1911	**5,280**	.....	.....	.....
Rochester—				
1910	6,000	.....	.....	.....
1911	**3,620**	.....	.....	.....
Saginaw—				
1910	51,750	.....	.....	.....
1911	**45,500**	.....	.....	.....
Sault Ste. Marie—				
1910	11,500	.....	.....	.....
1911	**9,100**	.....	.....	.....
Three Rivers—				
1910	2,640	.....	.....	.....
Whitehall—				
1910	7,640	.....	.....	.....
Wyandotte—				
1911	**4,000**	.....	.....	.....

MINNESOTA.

Bemidji—				Undetermined
1910	5,280	.....	.....	.....
1911	.....	.....	.....	**5,280**
Cannon Falls—				
1910	600	.....	.....	.....
Cloquet—				
1910	5,280	.....	.....	.....
1911	**10,560**	.....	.....	.....
Crookston—				
1911	**11,400**	.....	.....	.....
Faribault—				
1910	5,875	450	.....	.....
1911	**3,500**	**350**	.....	.....
Madelia—				
1911	**2,000**	.....	.....	.....
Mankato—				
1910	1,320	.....	.....	.....
Montevideo—				
1910	5,800	.....	.....	.....
1911	**5,000**	.....	.....	.....
New Ulm—				
1910	5,800	.....	.....	.....
1911	**1,320**	.....	.....	.....
Red Wing—				
1910	37,500	.....	.....	.....
1911	.....	.....	**26,400**	.....
St. Cloud—				Tile
1911	.....	.....	.....	**5,280**
St. Faul—				
1910	125,717	.....	5,702	.....
St. Peter—				
1910	2,700	.....	.....	.....
1911	**1,500**	.....	.....	.....
Two Harbors—				
1910	7,600	.....	.....	.....
Winona—				
1910	7,111	.....	.....	.....
1911	**10,000**	.....	.....	.....

MISSISSIPPI.

Cities	Cement	Brick	Wood	Others
Clarksdale—				
1910.....	10,560	.....	.....	.....
Progress.	2,000	.....	.....	.....
1911.....	**5,000**	.....	.....	.....
Hattiesburg—				
1910.....	12,000	.....	.....	.....
1911.....	**13,200**	.....	.....	.....
Yazoo City—				
1910.....	2,500	.....	3,425	.....
Progress.	1,044	.....	800	.....

MISSOURI.

Brookfield—				
1910.....	31,700	.....	.....	.....
Fulton—				
1910.....	4,650	.....	.....	.....
Independence—				
1910.....	23,300	.....	.....	.....
1911.....	**18,200**	.....	.....	.....
Kansas City—				
1910.....	65,000	.....	.....	.....
Lebanon—				
1910.....	5,280	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Lexington—				
1910.....	2,000	.....	.....	.....
1911.....	**1,000**	.....	.....	.....
Libertyville—				
1910.....	2,640	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Moberly—				
1910.....	21,100	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Nevada—				
1910.....	8,000	6,000	.....	.....
1911.....	**20,000**	**4,000**	.....	.....
St. Joseph—				
1910.....	29,638	3,566	5,289	.....
Progress.	1,019	.....	.....	.....
1911.....	.....	**225**	.....	.....
Sedalia—				
1910.....	31,700	.....	.....	.....
1911.....	**52,800**	.....	.....	.....
Tarkio—				
1910.....	300	.....	.....	.....
Webb City—				
1910.....	30,365	251	.....	.....
1911.....	**40,000**	.....	.....	.....

MONTANA.

Billings—				
1910.....	84,500	.....	.....	.....
Progress.	36,400	.....	.....	.....
1911.....	**18,200**	.....	.....	.....
Bozeman—				
1910.....	6,650	.....	.....	.....
1911.....	**47,500**	.....	.....	.....
Butte—				
1910.....	20,024	.....	.....	.....
1911.....	**7,940**	.....	.....	.....
Deer Lodge—				
1910.....	35,000	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Glasgow—				
1910.....	2,200	.....	.....	.....
1911.....	**9,100**	.....	.....	.....
Great Falls—				Earth
1910.....	41,000	.....	.....	17,550
1911.....	**45,500**	.....	.....	**20,000**
Helena—				
1910.....	30,600	.....	.....	.....
1911.....	**20,900**	.....	.....	.....
Lewiston—				
1910.....	7,920	.....	.....	.....
1911.....	**10,560**	.....	.....	.....

NEBRASKA.

Chadron—				
1910.....	690	.....	.....	.....
1911.....	**1,900**	.....	.....	.....
Hastings—				
1910.....	26,400	5,280	.....	.....
Lincoln—				
1910.....	69,000	5,280	.....	.....
1911.....	**69,000**	.....	.....	.....
Norfolk—				
1910.....	21,200	.....	.....	.....
1911.....	**21,200**	.....	.....	.....

Cities	Cement	Brick	Wood	Others
Red Cloud—				
1910.....	5,280	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
S. Omaha—				
1910.....	10,560	7,900	.....	.....
University Place—				
1911.....	**3,000**	.....	.....	.....
Wymore—				
1911.....	**7,920**	.....	.....	.....

NEVADA.

Reno—				
1910.....	14,605	.....	.....	.....

NEW JERSEY.

Bayonne—				Bluestone
1910.....	43,400	.....	.....	.....
Progress.	.....	.....	.....	3,160
Beach Haven—				
1911.	Cement walks throughout borough.			
Bloomfield—				Bluestone
1910.....	14,500	.....	.....	13,300
1911.....	**15,840**	.....	.....	**21,150**
Elizabeth—				Flagstone
1911.....	.....	.....	.....	**2,600**
Garfield—				
1910.....	21,100	.....	.....	.....
Irvington—				
1910.....	.....	.....	.....	21,800
Progress.	.....	.....	.....	10,900
Millville—				
1910.....	15,840	.....	.....	.....
1911.....	**21,150**	.....	.....	.....
Nutley—				
1910.....	29,000	.....	.....	.....
Ocean City—				
1910.....	21,150	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Passaic—				Bluestone
1911.....	.....	.....	.....	**16,296**
Plainfield—				
1910.....	31,100	.....	.....	.....
1911.....	**20,000**	.....	.....	.....
Rutherford—				Bluestone
1910.....	13,700	.....	.....	22,700
1911.....	**10,560**	.....	.....	**13,200**
Westfield—				
1910.....	43,250	.....	.....	.....

NEW MEXICO.

Silver City—				
1910.....	26,400	.....	.....	.....

NEW YORK.

Amsterdam—				
1910.....	.....	3,000	.....	.....
Batavia—				
1910.....	16,000	.....	.....	.....
Binghamton—				
1910.....	26,744	.....	.....	.....
1911.....	**26,744**	.....	.....	.....
Brockport—				
1910.....	300	.....	.....	.....
Buffalo—				
1910.....	131,400	.....	.....	.....
1911.....	**132,200**	.....	.....	.....
Corning—				
1910.....	11,950	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Dunkirk—				
1910.....	20,100	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Elmira—				
1910.....	25,000	.....	.....	*
1911.....	**25,000**	.....	.....	†

* Tar, 1,440 feet; stone, 1,740 feet, completed in 1910.

† Tar, 1,000 feet; stone ,1,700 feet, in prospect for 1911.

Herkimer—				
1910.....	15,700	.....	.....	.....
Hoosick Falls—				
1910.....	19,100	.....	.....	.....
1911.....	**6,400**	.....	.....	.....
Kingston—				
1911.....	**1,670**	.....	.....	.....
Little Falls—				
1910.....	7,920	.....	.....	.....
1911.....	**10,560**	.....	.....	.....

Cities	Cement	Brick	Wood	Others
New York City, Borough of Brooklyn—				
1910.....	135,000	.....	.....	.....
Progress.	64,000	.....	.....	.....
1911.....	**210,000**	.....	.....	.....
New York City, Borough of The Bronx—				Bluestone
1910.....	.....	.....	.....	83,952
Niagara Falls—				
1910.....	509	.....	.....	.....
Progress.	2,850	.....	.....	.....
1911.....	**2,500**	.....	.....	.....
Olean—				
1910.....	18,500	2,640	5,280	.....
1911.....	**26,400**	.....	.....	.....
Ogdensburg—				
1910.....	4,460	.....	.....	.....
1911.....	**4,000**	.....	.....	.....
Oneida—				
1910.....	2,640	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Potsdam—				Sandstone
1910.....	500	.....	.....	700
Plattsburg—				
1910.....	14,000	.....	.....	.....
1911.....	**10,000**	.....	.....	.....
Salamanca—				
1910.....	7,000	800	.....	.....
1911.....	**6,000**	.....	.....	.....
Solvay—				
1910.....	36,500	.....	.....	.....
1911.....	**42,200**	.....	.....	.....
Syracuse—				
1910.....	48,900	.....	.....	.....
1911.....	**47,600**	.....	.....	.....
Watertown—				
1910.....	39,600	.....	.....	.....
1911.....	**31,700**	.....	.....	.....
White Plains—				Bluestone
1910.....	2,500	.....	.....	3,000
NORTH CAROLINA.				
Asheville—				
1910.....	6,000	.....	.....	.....
Greenville—				
1910.....	3,000	.....	1,000	.....
1911.....	**5,000**	.....	.....	.....
Hendersonville—				
1910.....	15,800	.....	.....	.....
1911.....	**21,000**	.....	.....	.....
Raleigh—				
1910.....	2,000	.....	.....	.....
Wilson—				
1910.....	21,120	.....	.....	.....
NORTH DAKOTA.				
Bismarck—				
1910.....	2,000	.....	.....	.....
Grand Forks—				
1910.....	15,800	.....	.....	.....
1911.....	.....	.....	**10,600**	.....
Jamestown—				
1910.....	10,560	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Mandan—				
1910.....	21,100	.....	.....	.....
1911.....	**21,100**	.....	.....	.....
Minot—				
1910.....	5,000	.....	.....	.....
1911.....	**6,000**	.....	.....	.....
Wahpeton—				
1910.....	4,000	.....	.....	.....
1911.....	**2,500**	.....	.....	.....
Williston—				
1910.....	10,026	.....	.....	.....
1911.....	**23,800**	.....	.....	.....
OHIO.				
Akron—				
1910.....	6,350	.....	.....	.....
Progress.	3,280	.....	.....	.....
1911.....	**31,800**	.....	.....	.....
Bellefontaine—				
1910.....	1,340	.....	.....	.....
1911.....	**1,600**	.....	.....	.....
Bowling Green—				Flagstone
1910.....	3,000	.....	.....	3,000
Progress.	.....	.....	.....	1,300
1911.....	**2,000**	.....	.....	**2,000**
Bucyrus—				Stone
1910.....	2,353	.....	.....	15,259
Carrolton—				
1910.....	2,000	6,000	.....	.....
1911.....	**2,500**	**10,000**	.....	.....
Chillicothe—				
1910.....	13,200	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Conneaut—				
1910.....	6,600	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Cleveland Heights—				Stone
1910.....	7,920	.....	.....	10,560
1911.....	**2,640**	.....	.....	**13,200**
Delaware—				
1910.....	2,640	.....	.....	.....
E. Cleveland—				Stone
1911.....	.....	.....	.....	**2,640**
Cincinnati—				
1910.....	146,000	2,100	34,400	.....
Defiance—				
1910.....	15,800	.....	.....	.....
Euclid—				Stone
1911.....	.....	.....	.....	**2,640**
Findlay—				
1910.....	7,920	.....	.....	.....
1911.....	**7,920**	.....	.....	.....
Galion—				
1910.....	.....	.....	.....	5,280*
1911.....	.....	.....	.....	21,100*
* Stone, flag and cement.				
Greenville—				
1910.....	5,000	.....	.....	.....
1911.....	**8,000**	.....	.....	.....
Ironton—				
1910.....	18,800	.....	.....	.....
Lancaster—				
1910.....	782	.....	.....	.....
Leetonia—				
1910.....	1,500	.....	.....	2,000
Progress.	150	.....	.....	800
1911.....	**2,000**	.....	.....	**3,000**
Lorain—				Sandstone
1910.....	.....	.....	.....	12,000
1911.....	.....	.....	.....	**21,800**
Miamisburg—				
1910.....	7,920	.....	.....	.....
Millersburg—				
1910.....	500	.....	.....	.....
Progress.	1,200	.....	.....	.....
Napoleon—				Flag
1910.....	1,270	180	.....	180
1911.....	**1,090**	.....	.....	.....
Niles—				Stone
1910.....	2,000	.....	.....	6,000
1911.....	**8,000**	.....	.....	**12,000**
Norwood—				
1910.....	7,920	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Oberlin—				Stone
1910.....	.....	.....	.....	2,720
1911.....	.....	.....	.....	1,820
Pomeroy—				
1910.....	1,000	.....	.....	.....
Port Clinton—				
1910.....	5,280	.....	.....	.....
Steubenville—				
1910.....	10,560	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Toledo—				Flag
1910.....	59,664	.....	.....	112,200
1911.....	**59,664**	.....	.....	**112,200**
Wadsworth—				
1911.....	.....	.....	.....	**15,800**
Warren—				Sandstone
1910.....	2,640	.....	.....	2,640
1911.....	**2,640**	.....	.....	2,640
Youngstown—				
1910.....	26,400	.....	.....	.....
OKLAHOMA.				
Bartlesville—				
1910.....	21,200	400	.....	.....
1911.....	**10,560**	.....	.....	.....
Chandler—				
1910.....	15,800	15,800	.....	.....
1911.....	**21,100**	.....	.....	.....
Clinton—				
1910.....	79,400	.....	.....	.....
1911.....	**79,400**	.....	.....	.....

Cities	Cement	Brick	Wood	Others
El Reno—				
1910.....	63,500	15,800	.....	.....
Progress.	10,560	.....	.....	.....
1911.....	**43,200**	.....	.....	.....
Enid—				
1910.....	105,600	.....	.....	.....
1911.....	**79,400**	.....	.....	.....
Lawton—				
1910.....	15,800	.....	.....	.....
Progress.	6.600	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Muskogee—				
1910.....	46,280	880	.....	.....
Progress.	3,400	.....	.....	.....
1911.....	**40,000**	**1,000**	.....	.....
Norman—				
1910.....	21,100	2,640	.....	.....
Progress.	10,560	.....	.....	.....
1911.....	43,200	.....	.....	.....
Shawnee—				
1910.....	52,800	5,280	.....	.....
1911.....	**52,800**	.....	.....	.....
Tulsa—				
1910.....	18,200	.....	.....	.....
1911.....	**13,600**	.....	.....	.....
Vinita—				
1910.....	105,600	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
OREGON.				
Cloquille—				
1910.....	500	.....	1,000	.....
1911.....	**2,000**	.....	.....	.....
The Dalles—				
1910.....	21,170	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Marshfield—				
1910.....	.....	.....	31,700	.....
Progress.	.....	.....	5,280	.....
1911.....	.....	.....	**10,560**	.....
Portland—				
1910.....	611,318	.....	35,387	.....
PENNSYLVANIA.				
Bellefonte—				Flagstone
1910.....	1,900	.....	.....	400
Bellwood—				
1910.....	1,000	1,000	.....	.....
1911.....	**2,000**	.....	.....	.....
Carbondale—				Stone
1911.....	.....	.....	.....	**26,400**
Chambersburg—				
1910.....	9,667	.....	.....	.....
Corry—				
1910.....	3,670	452	.....	.....
Doyleston—				
1910.....	600	.....	.....	.....
Gallitzin—				
1910.....	2,640	.....	.....	.....
1911.....	**1,320**	.....	.....	.....
Homestead—				
1910.....	.....	276	.....	.....
1911.....	.....	300	.....	.....
Luzerne—				
1910.....	1,320	.....	.....	.....
McKees Rock—				
1910.....	13,200	.....	.....	.....
1911.....	**20,000**	.....	.....	.....
Minersville—				
1910.....	300	.....	.....	.....
Newcastle—				
1910.....	23,360	.....	.....	.....
Northeast—				
1910.....	105,600	5,280	.....	.....
Northumberland—				Stone
1910.....	1,892	.....	.....	120
Oil City—				
1910.....	11,500	.....	.....	.....
Pottsville—				Flagstone
1910.....	20,000	26,000	.....	.....
1911.....	.....	.....	.....	**13,591**
Reading—				
1910.....	.....	600	.....	.....
Sharpsville—				
1911.....	**5,280**	.....	.....	.....
Somerset—				
1910.....	2,000	.....	.....	.....
Swissvale—				
1910.....	1,780	.....	.....	.....
1911.....	**910**	.....	.....	.....
Tyrone—				
1910.....	5,280	2,640	.....	.....
Wilkes-Barre—				
1910.....	.....	.....	.....	10,400*
* Flagstone and concrete.				
Wilkinsburg—				
1910.....	211,600	52,800	10,560	.....
1911.....	.....	.....	5,280	.....
RHODE ISLAND.				
Woonsocket—				Tar concrete
1910.....	50	.....	.....	560
SOUTH CAROLINA.				
Chester—				
1910.....	1,000	.....	.....	.....
Progress.	1,000	.....	.....	.....
1911.....	**1,000**	.....	.....	.....
Florence—				
1911.....	**2,640**	.....	.....	.....
Greenville—				
1910.....	120	.....	.....	.....
1911.....	**2,000**	.....	.....	.....
Union—				
1910.....	10,560	.....	.....	.....
Progress.	21,120	.....	.....	.....
1911.....	**21,120**	.....	.....	.....
SOUTH DAKOTA.				
Aberdeen—				
1910.....	8,269	.....	.....	.....
Deadwood—				
1910.....	2,000	.....	.....	.....
Faulkton—				
1910.....	1,500	.....	.....	.....
1911.....	**2,400**	.....	.....	.....
Lead—				
1910.....	5,000	.....	2,000	.....
1911.....	**3,000**	.....	**2,000**	.....
Fierre—				
1910.....	10,560	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Rapid City—				
1910.....	7,000	.....	.....	.....
1911.....	**10,000**	.....	.....	.....
Sioux Falls—				
1910.....	44,900	.....	.....	.....
TENNESSEE.				
Columbia—				
1910.....	19,800	7,920	.....	.....
1911.....	**19,800**	**7,920**	.....	.....
Harris—				
1910.....	15,800	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Knoxville—				
1910.....	14,700	.....	.....	.....
1911.....	**79,400**	.....	.....	.....
Memphis—				
1911.....	**52,800**	.....	.....	.....
Rockwood—				
1910.....	10,560	.....	.....	.....
Progress.	2,640	.....	.....	.....
1910.....	278,098	.....	.....	.....
Nashville—				
1910.....	42,100	.....	.....	.....
TEXAS.				
Dallas—				
1910.....	.....	.....	.....	26,400
Denison—				
1910.....	42,300	2,640	.....	.....
1911.....	**105,600**	.....	.....	.....
Greenville—				
1910.....	26,400	.....	.....	.....
Texas City—				
Progress.	10,560	.....	.....	.....
1911.....	**21,100**	.....	.....	.....
UTAH.				
Ogden—				
1910.....	25,700	.....	.....	.....
Provo—				
1910.....	50,500	.....	.....	.....
Progress.	1,500	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Salt Lake City—				
1910.....	16.600	.....	.....	.....
1911.....	**316,500**	.....	.....	.....

VERMONT.

Cities	Cement	Brick	Wood	Others
Barre—				Tar concrete
1910.....	203	.....	.....	636
Bellows Falls—				Tar
1910.....	.....	.....	.....	2,620
1911.....	.....	.....	.....	**2,460**
St. Albans—				Tar concrete
1910.....	6,400	.....	.....	1,800

VIRGINIA.

Chatham—				
1910.....	5,280	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Danville—				
1910.....	32,650	57,500	.....	.....
Fredericksburg—				
1910.....	800	.....	.....	.....
1911.....	**2,000**	.....	.....	.....

WASHINGTON.

Bellingham—				
1910.....	65,515	.....	21,686	.....
1911.....	**28,260**	.....	4,000	.....
Colfax—				
1910	1,025	.....	.....	.....
Everett—				
1910.....	62,487	.....	.....	.....
Progress.	22,820	.....	.....	.....
1911.....	**87,300**	.....	.....	.....
Hoquiam—				
1910.....	10,000	20,000	.....	.....
1911.....	**6,000**	**15,000**	.....	.....
Kent—				
1910.....	7,920	.....	.....	.....
Fort Angeles—				
1910.....	.....	.....	42,200	.....
1911.....	.....	.....	**10,560**	.....
Seattle—				
1910.....	363,686	107,131	.....	.....
S. Yakima—				
1910.....	26,400	.....	.....	.....
Spokane—				
1910.....	493,680	.....	.....	.....
1911.....	**5,550**	.....		
Tacoma—				
1910 ..	254,951	.....	12,355	.....
1911.....	**53,592**	.....	**1,320**	.....
Walla-Walla—				
1910.....	20,000	.....	.....	.....
1911.....	**40,000**	.....	.....	.....

WISCONSIN.

Beloit—				
1910.....	26,400	.....	.....	.....
Berlin—				
1910.....	10,560	.....	.....	.....
Burlington—				
1910.....	11,100	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
DePere—				
1910.....	30,850	.....	.....	.....
Eau Claire—				
1910.....	5,280	.....	.....	.....
Fond du Lac—				
1910.....	42,250	.....	.....	.....
1911.....	**42,250**	.....	.....	.....
Hartford—				
1910.....	8,300	.....	.....	.....
Lacrosse—				
1910.....	25,523	.....	.....	.....
1911.....	**21,100**	.....	.....	.....

Cities	Cement	Brick	Wood	Others
Mazomanie—				
1910.....	3,920	.....	.....	.....
Milwaukee—				
1910.....	129,300	.....	.....	.....
1911.....	**136,000**	.....	.....	.....
Oshkosh—				
1910.....	64,750	.....	.....	.....
Port Washington—				
1910.....	9,250	.....	.....	.....
1911.....	**9,100**	.....	.....	.....
Stevens Point—				
1910.....	10,560	.....	.....	.....
Watertown—				
1910.....	12,000	.....	.....	.....
1911.....	**12,000**	.....	.....	.....
Waupaca—				
1910.....	2,100	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Waupun—				
1910.....	8,146	.....	.....	.....
1911.....	**8,146**	.....	.....	.....

WYOMING.

Laramie—				
1910.....	52,800	.....	.....	.....
1911.....	**42,250**	.....	.....	.....

CANADA.

Kingston, Ont.—				
1910.....	23,700	.....	.....	.....
1911.....	**21,150**	.....	.....	.....
Toronto, Ont.—				
1910.....	281,000	.....	12,700	.....
1911.....	Approximately same as 1910.			
Winnipeg, Man.—				
1910.....	47,800	.....	79,500	.....

CURB AND GUTTER

A few cities have made separate reports of curb and gutter improvements not connected with sidewalks or street paving, as follows:

Birmingham, Ala., has 10,000 feet of curb and gutter under construction and proposes to lay 25,000 feet in 1911.

Dothan, Ala., constructed 35,180 feet of curb and gutter in 1910, has 63,000 feet under construction and proposes to lay 63,500 feet in 1911.

Topeka, Kan., laid 28,500 feet of curb and gutter in 1910 and proposes to lay 47,284 feet in 1911.

Yazoo City, Miss., laid 1,700 feet in 1910 and has 344 feet under construction.

Cape Girardeau, Mo., laid 6,000 feet in 1910.

Sedalia, Mo., laid 18,500 feet in 1910 and will lay 26,400 feet in 1911.

Kingston, N. Y., will lay 3,115 feet of curb in 1911.

Vinita, Okla., laid 13,000 feet of curb and gutter in 1910 and has 1,400 feet under construction.

Aberdeen, S. D., laid 11,536 feet in 1910.

LaCrosse, Wis., laid 17,133 feet in 1910 and will lay 5,280 feet in 1911.

SEWER IMPROVEMENTS

Official Reports of Sewer Improvements Made to Municipal Engineering by the Municipal Officials of America

Arranged alphabetically by states and cities.

In the line "1910" under each city is given the number of linear feet of each class of sewer laid in the year 1910.

In the line "Progress" is given the number of linear feet of each class of sewer in process of construction.

In the line "1911" is given the number of linear feet of each class of sewer pro-

posed for construction during 1911, printed in heavy type so that it can be distinguished readily.

In a few cities general statements only could be made. These will be found in their proper places in the table.

Following the table giving the length of sewers reported will be found items arranged in the same order of states and cities, giving information about recent and proposed construction of sewage pumping and sewage disposal plants, etc.

ALABAMA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Birmingham—				
Storm sewers, $300,000, under contract.				
Dothan—				
1910		2,883	60	20,000
1911				**3,000**
Jasper—				
1910				3,960
1911				**5,280**
New Decatur—				
1910			1,850	278,100
Progress.				2,180
1911				**5,280**
Talladega—				
1910				5,000

ARIZONA.

Tucson—				
1910				6,600

ARKANSAS.

Batesville—				
1911				**5,280**
Ft. Smith—				
1910				42,702
1911				**20,000**

CALIFORNIA.

Alhambra—				
1910				13,200
Antioch—				
1910				4,500
Coalinga—				
1911				**37,000**
E. San Jose—				
1910	3,920			74,000
Emoryville—				
1910		1,800		
Lodi—				
1910				63,400
Los Angeles—				
1910				230,000
Progress.				59,100
1911				**238,000**
Long Beach—				
In prospect for 1911, 792,000 feet of sewer, including 6,350 feet of main outfall.				
Oakland—				
1910	2,640	14,300		124,000
Progress.		15,800		26,400
1911		**21,100**		**105,600**
Palo Alto—				
1910				929
Pasadena—				
1910				1,097
Progress.			14,450	
1911				**39,200**
Portersville—				
1910				70,000
Progress.				25,000
San Bernardino—				
1910				18,500
San Jose—				
1910				11,403
Progress.				800
1911		**10,500**		
San Mateo—				
1911			**5,000**	**10,000**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Santa Clara—				
1910				10,560
1911				**63,500**
Santa Cruz—				
1910				10,543
1911				**17,041**
S. Pasadena—				
1910	3,400	1,800		3,200
Visalia—				
1910				1,320
1911				**2,640**
Watsonville—				
1910			10,902	1,937

CONNECTICUT.

Ansonia—				
1910				5,800
Progress.				6,500
1911				**15,000**
Bristol—				
1910				2,000
Hartford—				
1910	28	62,500	300	7,900
Progress.	400			
1911	**4,800**			**1,000**
Meriden—				
1910				3,950
New Britain—				
1910				11,500
1911				**15,800**
New Haven.				
1910	321		638	12,868
Torrington*—				
1910			180	5,326
1911			**1,700**	
*800 feet of castiron pipe proposed for 1911.				
Wallingford—				
1911				**5,000**

DISTRICT OF COLUMBIA.

Washington—Has $379,000 worth of sewer work in progress, and will do $446,500 in 1911.

GEORGIA.

Americus—				
1910				21,120
Atlanta—				
1910	13,834			51,797
1911	**10,560**	**79,200**		**211,200**
Cordele—				
1910				2,800
Eastman—				
1910				45,000
Valdosta—				
1910				5,750

IDAHO.

Payette—				
1910				23,000
1911				**30,000**
Pocatello—				
1911				**10,560**

ILLINOIS.

Aurora—				
1911		**2,640**		**42,300**
Canton—				
1910	10,560			36,900
1911				**2,640**
Chicago—				
1910	79,643	2,000	1,000	216,448
Chicago Heights—				
1910		3,980	5,800	13,200
Progress.				13,200
1911				**89,700**
Collinsville—				
1910				15,800
1911				**13,200**
Danville—				
1910				5,280
Progress.				2,640
1911				**52,800**
Decatur—				
1910				11,567

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Dekalb—				
1911	.....	.....	.....	**71,400**
E. St. Louis—				
1910	.....	1,800	4,200	30,500
Edwardsville—				
1910	.....	.....	.....	2,000
Elgin—				
1910	.....	.....	.....	9,737
Progress.	.....	5,192	144	39,907
1911	.....	**853**	**4,197**	**41,935**
Freeport—				
1911	.....	**1,000**	.....	**47,400**
Galena—				
1910	.....	.....	.....	8,550
Galesburg—				
1910	.....	.....	.....	17,690
1911	.....	.....	.....	**15,598**
Granite City—				
1910	.....	.....	.....	15,000
Harvey—				
1910	.....	.....	.....	1,117
Joliet—				
1910	.....	.....	.....	6,230
1911	.....	.....	.....	**5,000**
Lagrange—				
1911	.....	**15,800**	.....	.....
Mattoon—				
1910	.....	.....	.....	7,300
1911	.....	.....	.....	**10,560**
Metropolis—				
1910	 5,260	.....	.....	40,973
Moline—				
1910	.....	.....	.....	27,000
Progress.	.....	.....	.....	15,800
Oak Park—				
1910	.....	.....	.....	4,400
1911	..... **11,900**	.....	.....	**10,560**
Paris—				
1910	.....	.....	.....	9,000
1911	.....	.....	**4,800**	.....
Peoria*—				
1910	 52,800	.....	.....	158,400
1911	.....	.....	.....	**3,960**

*462 ft. of pipe contracted for.

Petersburg—				
1910	.....	.....	.....	1,800
Rockford—				
1910	.....	.....	486	25,000
1911	.....	.....	**1,700**	**5,700**
Rock Island—				
1910	.....	.....	.....	23,040
1911	.....	.....	**2,600**	**18,080**
Streator—				
1910	.....	.....	.....	3,980
Taylorville—				
1910	.....	.....	.....	9,560
1911	.....	.....	.....	**21,200**
Waukegan—				
1910	.....	.....	7,900	66,000
1911	.....	.....	.....	**36,300**
Wheaton*—				
1910	.....	.....	.....	25,000
1911	.....	.....	.....	**30,000**

*22,700 feet of open ditch in 1910.

INDIANA.

Anderson—				
1910	.....	.....	.....	2,640
Angola—				
1910	.....	.....	4,789	19,140
Brazil—				
1910	.....	.....	.....	400
Columbia City—				
Progress.	.....	.....	.....	1,320
Columbus—				
Progress.	.....	.....	.....	13,200
1911	.....	.....	.....	**10,560**
Converse—				
1910	.....	.....	.....	10,560
Crawfordsville—				
1910	.....	.....	.....	2,170
1911	.....	.....	.....	**5,120**
E. Chicago—				
1910	 13,200	.....	.....	47,400
1911	..... **5,280**	.....	.....	**13,200**
Evansville—				
1910	 2,167	.....	10,064	2,067
Progress.	1,409	.....	.....	5,439
1911	.....	.....	.....	**20,000**
Ft. Wayne—				
1910	.....	.....	.....	15,800
Progress.	.....	.....	.....	17,300
1911	.....	.....	.....	**6,870**
Hammond—				
1910	.....	.....	.....	10,269
Huntington—				
1910	 865	.....	.....	.....
Indianapolis*—				
Progress.	22,000	.....	.....	38,000

*127,037 feet of brick, concrete and vitrified pipe sewer constructed in 1910.

Kokomo—				
1910	.....	.....	.....	20,000
1911	.....	.....	**9,376**	**5,800**
Lebanon*—				
1910	.....	.....	.....	2,640

*31,600 feet of sewer proposed for 1911, kind not decided.

Logansport—				
1910	.....	.....	.....	1,800
1911	.....	.....	.....	**1,000**
Marion—				
1910	.....	.....	2,650	7,940
Martinsville—				
1910	 2,640	.....	.....	.....
Michigan City—				
1910	.....	.....	.....	7,000
Mishawaka—				
1910	.....	.....	.....	15,200
Muncie—				
1910	.....	.....	.....	2,500
1911	.....	.....	.....	**650**
Newcastle—				
1910	.....	.....	.....	10,560
Progress.	.....	.....	.....	5,280
1911	.....	**10,560**	.....	.....
Peru—				
1910	.....	.....	.....	1,000
1911	.....	.....	.....	**2,640**
Remington—				
1911	.....	.....	.....	**3,000**
Richmond—				
1910	.....	3,280	.....	.....
1911	.....	**1,320**	.....	**6,600**
South Bend—				
1910	.....	.....	4,657	4,655
Terre Haute—				
1910	 21,400	.....	.....	.....
Wabash—				
1910	.....	.....	.....	1,900
1911	.....	.....	.....	**4,500**

IOWA.

Ames—				
1910	.....	.....	.....	79,400
Albia—				
1910	.....	.....	.....	6,000

Belle Plaine—
Will construct 26,400 feet of sewer in 1911.

Burlington—				
1910	.....	.....	1,358	11,055
Carroll—				
1910	.....	.....	.....	15,800
Cedar Falls—				
1910	.....	.....	.....	18,450
Cedar Rapids—				
1910	.....	.....	.....	24,500
Progress.	.....	.....	.....	3,000
Centerville—				
1910	.....	.....	.....	3,800
Charles City—				
1910	.....	.....	.....	22,500
1911	.....	.....	.....	**15,800**
Clinton—				
1910	.....	.....	.....	2,500
1911	..... **2,540**	.....	.....	**32,000**
Creston—				
1910	.....	.....	.....	3,329

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Des Moines—				
1910			2,665	28,852
Eldora—				
1910				1,200
1911				**1,500**
Ft. Dodge—				
1910				21,400
1911				**10,560**
Glenwood—				
1910				9,650
Grinnell—				
1910				5,866
Independence—				
1910		1,650		
Indianola—				
1910				20,095
1911				**40,000**
Knoxville—				
1910				6,000
Mason City—				
1910				15,800
1911				**5,280**
Newton—				
1910				26,400
Osage—				
Sewer system to be installed.				
Pella—				
1910				15,800
Red Oak—				
1910				800
Washington—				
1910				1,500
Progress.				500
Sigourney—				
1911			**47,500**	
Waterloo—				
1910				42,400

KANSAS.

Abilene—				
1910				42,300
Argentine—				
1910				7,920
Progress.				5,280
1911	**5,280**			
Arkansas City—				
1910	24,700			
1911	**15,800**		**3,980**	
Burlington—				
1910				42,200
Chanute—				
1910				10,164
Clay Center—				
1910				5,000
Emporia—				
1910			2,640	
Holton—				
1910				42,200
Progress.				18,500
Hutchinson—				
1910			3,800	14,000
Lawrence—				
1910	2,640		2,640	13,200
Progress.				6,600
1911				**10,560**
Manhattan—				
1910			9,000	3,000
Progress.				79,500
McPherson—				
1911	**10,560**			
Newton—				
1910				79,200
Olathe—				
1910				2,500
1911				**7,000**
Pittsburg—				
1910				12,021
1911				**1,900**
Pratt—				
1910				37,000
Selina—				
1910				8,500
1911				**8,000**
Topeka*—				
1910				2,608

*No sewer work in prospect for 1911.

KENTUCKY.

Ashland—				
1911				**1,000**
Louisville—				
1910				38,706
1911		**751**		**40,000**
Maysville—				
1910				1,320
1911				**660**
Owensboro—				
1910	200			5,000
Winchester—				
1910				7,960
1911				**34,400**

LOUISIANA.

Morgan City—				
1910				10,560

MAINE.

Lewistown—				
1910				1,200
1911				**4,000**

MASSACHUSETTS.

Boston—
Owing to the establishment of a Department of Public Works and the consequent disorder and wholesale moving of quarters, the desired data are not at hand.

Easthampton—				
1910				4,000
1911				**5,000**
Everett—				
1910				1,950
Greenfield—				
1910				3,530
Progress.				7,500
1911				**10,000**
Hinsdale—				
1910				630
Lawrence*—				
1910				19,054

*1,368 feet of sewer, with brick arch and concrete invert constructed in 1910.

Lowell—				
1910	200			9,900
Medford—				
1910				6,454
New Bedford*—				
1910			2,309	21,898
1911			**2,000**	**22,000**

*6,400 feet of outfall sewer and screen chamber proposed for 1911.

Quincy—				
1910				24,634
1911				**24,000**
Webster—				
1910				1,770
Worcester—				
1910				5,000
Progress.				1,000

MICHIGAN.

Alpena*—				
1910				9,646

*557 feet of plank sewer constructed in 1910.

Battle Creek—				
1910				14,240
Benton Harbor—				
1910				1,500
1911				**500**
Cadillac—				
1910				1,100
1911				**3,000**
Flint—				
1910			31,200	54,400
Gladwin—				
1910				1,000
1911				**1,000**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Grand Rapids*—				
1910		2,856		30,448
Progress.				4,813
*2,657 feet of Parmley block sewer constructed in 1910.				
Greenville—				
1910				29,646
Hancock—				
1910				7,590
Progress.				2,900
1911				**22,000**
Highland Park—				
1910				42,200
Jackson—				
1910			2,900	10,560
1911			**7,920**	**10,560**
Kalamazoo—				
1910				11,287
Progress.			51,000	
1911				**15,000**
Lansing—				
1910	4,000			10,560
Progress.				2,400
Manistique—				
1910				3,900
Marine City—				
1910				1,812
Marshall—				
1910				3,524
1911				**3,500**
Negaunee—				
1911				**4,000**
Niles—				
$22,000 worth of sewers proposed for 1911.				
Norway—				
1910				2,000
1911				**2,000**
Port Huron—				
1910		125		2,640
Rochester—				
1910				300
Saginaw—				
1910		1,200		9,650
Progress.		3,675		
Sault Ste. Marie—				
1910				2,426
1911				**10,000**
Three Rivers—				
1910				3,960
1911				**2,640**

MINNESOTA.

Bemidji—				
1910				3,200
1911				**2,640**
Cannon Falls—				
1910				1,250
Cloquet—				
1910				7,700
1911				**15,000**
Crookston—				
1910				3,830
1911				**860**
Faribault*—				
1910				8,253
1911				**3,000**
*3,230 feet of cement tile sewer constructed in 1910 and 1,500 feet proposed for 1911.				
Hastings—				
1910				2,227
Progress.				3,000
1911				**1,500**
Mankato—				
1910			15,000	700
1911				**1,200**
Montevideo—				
1910				3,800
1910				**2,000**
New Ulm—				
1910				430
Red Wing—				
1910				2,640
1911				**5,280**
St. Cloud—				
1911				**42,100**
St. Peter—				
1910	700			
St. Paul—				
Progress.				3,960
1911			**5,280**	**42,240**
Winona—				
1910				1,100
1911				**2,000**

MISSISSIPPI.

Clarksdale—				
1910				2,640
1911				**10,560**
Hattiesburg—				
1911				**10,000**
Yazoo City—				
1910				100

MISSOURI.

Aurora—				
1911—Complete system for city of 5,000.				
Brookfield—				
1910				2,640
1911				**2,640**
Clinton—				
1910				48,000
Glasgow—				
1911				**10,560**
Independence*				
1910				7,451
*10,000 feet of sewer proposed for 1911, kind not decided.				
Kansas City—				
1910		5,023		49,001
Libertyville—				
1910				5,280
Moberly—				
1910	5,000		21,100	
1910			**42,250**	
Nevada—				
1910				2,000
1911		**14,000**		**3,000**
Oregon—				
1911—City sewerage plant.				
St. Joseph—				
1910		5,633		59,291
Progress.		3,702		2,117
1911				**2,197**
Sedalia—				
1910				3,530
1911				**52,800**
Webb City—				
1910				14,428
Progress.				3,528

MONTANA.

Billings—				
1910			6,446	101,800
Bozeman—				
1910				1,950
1911				**1,200**
Butte—				
550 feet of cement tile and 150 feet of wooden outlet sewer constructed in 1910; 500 feet of cement tile sewer proposed for 1911.				
Deer Lodge—				
1910				15,800
1911				**5,280**
Glasgow—				
1910				10,560
1911				**7,920**
Great Falls—				
1910				16,709
1911				**30,000**
Helena—				
1910		5,390		23,554
1911				**2,450**
Lewiston—				
1910				4,000
1911				**10,000**

NEBRASKA.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Chadron—				
1910	.....	.....	.....	42,250
1911	.....	.....	.....	**4,000**
Hastings—				
1911	.....	.....	.....	**7,940**
Lincoln—				
1910	.....	4,561	.....	32,542
1911	.....	**5,000**	.....	**30,000**
Neligh—				
One mile of sewer constructed in 1910 and complete system proposed for 1911.				
Norfolk*—				
1910	.....	200	.....	5,000
1911	.....	.....	.....	**3,000**
*500 feet of cast iron sewer constructed in 1910.				
S. Omaha—				
1910	1,244	3,505	200	4,815
Progress.	.....	9,979	.....	590
Tecumseh—				
1911	.....	.....	.....	**34,000**
University Place—				
1911	.....	.....	.....	**9,000**

NEVADA.

Reno—				
1910	.....	.....	.....	23,263
1911	.....	**10,560**	.....	.....

NEW HAMPSHIRE.

Keene—				
1910	.....	.....	.....	2,363
Littleton—				
1910	.....	.....	.....	1,850

NEW JERSEY.

Bayonne—				
1910	.....	.....	.....	3,620
Bloomfield—				
1910	.....	2,000	4,400	15,790
1911	.....	.....	**10,560**	**15,800**
Dover—				
Considering complete sewerage system.				
Elizabeth—				
1910	4,000	.....	9,393	.....
1911	**1,200**	.....	.....	.....
Garfield—				
1910	.....	.....	.....	2,640
1911—Complete sewer system proposed.				
Irvington—				
1910	.....	.....	.....	18,000
Jersey City*—				
1910	5,329	.....	.....	5,470
Progress.	3,910	.....	2,460	4,928
*1,857 feet of steel pipe sewer under contract.				
Ocean City—				
1910	.....	.....	.....	10,560
Plainfield—				
1910	.....	.....	.....	13,200
1911	.....	.....	.....	**12,000**
Rutherford—				
1910	.....	.....	.....	6,350
Progress.	.....	.....	.....	5,000
1911	.....	.....	.....	**7,940**
S. Amboy—				
Progress.	.....	.....	.....	31,700
Westfield—				
1910	.....	.....	.....	14,800

NEW MEXICO.

Silver City—				
1910	.....	.....	.....	47,500

NEW YORK.

Amsterdam—				
1910	10,501	.....	.....	.....
Batavia—				
1910	.....	.....	.....	79,000
1911	.....	.....	.....	**79,000**
Binghamton—				
1910	.....	.....	.....	23,800
1911	.....	.....	.....	**26,400**
Buffalo—				
1910	3,108	770	.....	51,415
1911	**19,910**	.....	.....	**42,362**
Catskill—				
1910	.....	.....	.....	1,500
Corning—				
1910	.....	.....	.....	6,200
1911	.....	.....	.....	**5,280**
Dunkirk—				
1910	400	.....	.....	6,850
Elmira—				
1910	.....	.....	.....	4,698
1911	.....	.....	.....	**4,000**
Frankfort—				
1911..$55,000 to $85,000 voted for complete sewerage system. If larger sum is used, disposal plant will be erected.				
Geneseo—				
1911	.....	.....	.....	**1,320**
Herkimer—				
1910	.....	.....	.....	3,150
Jamestown—				
1910	.....	.....	.....	47,500
Kingston—				
1910	.....	.....	.....	3,700
1911	.....	**1,000**	.....	**4,000**
Little Falls—				
1910	.....	.....	.....	2,500
Middletown—				
1910	.....	.....	.....	3,000
New York City (Borough of The Bronx)—				
1910	.....	2,006	1,637	40,128
Progress.	.....	3,168	6,336	33,264
1911	.....	.....	**10,560**	**27,984**
Niagara Falls*—				
1910	1,866	.....	605	19,796
1911	.....	.....	**1,700**	**4,200**
*1,500 feet of tunnel constructed in 1910; 1,742 feet proposed for 1911.				
Ogdensburg—				
1910	.....	.....	.....	1,544
Olean—				
1910	.....	.....	.....	18,500
1911	.....	.....	.....	**15,800**
Oneida—				
1910	.....	.....	.....	2,640
Progress.	.....	.....	.....	1,320
1911	.....	.....	.....	**3,960**
Plattsburg—				
1910	.....	.....	.....	2,640
1911	.....	.....	.....	**800**
Potsdam—				
1910	.....	.....	.....	1,600
Salamanca—				
1910	.....	.....	.....	6,800
1911	.....	.....	.....	**4,200**
Sidney—				
1911	.....	.....	.....	**700**
Syracuse*—				
1910	4,150	330	.....	26,020
Progress.	.....	.....	.....	4,540
1911	.....	.....	.....	**45,400**
*8,800 feet of sewer of kinds not yet determined proposed for 1911.				
Troy—				
1910	80	.....	14,234	.....
Utica—				
1910	.....	.....	.....	11,580
Watertown—				
1910	.....	.....	5,280	5,280
1911	.....	.....	.....	**7,940**
White Plains—				
1910	.....	.....	.....	1,000

NORTH CAROLINA.

Asheville—				
1910	.....	.....	.....	21,100
Greenville—				
1910	.....	.....	.....	4,000
1911	.....	.....	.....	**2,500**
*8,000 feet of storm water sewer constructed in 1910; 1,000 feet proposed for 1911.				
Hendersonville—				
1910	.....	.....	.....	15,800
Progress.	.....	.....	.....	10,560
1911	.....	.....	.....	**5,280**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Raleigh—				
1910	.....	.....	.....	10,560
Wilmington—				
1911—Plans being made for complete system.				
Wilson—				
1910	.....	.....	.....	3,000
1911	**3,200**	.....	.....	.....
NORTH DAKOTA.				
Bismarck—				
1910	.....	.....	.....	6,500
Grand Forks*—				
1910	2,000	.....	.....	10,270
*5,280 feet of sewer proposed for 1911, kind undecided.				
Jamestown—				
1910	.....	.....	.....	2,640
1911	.....	.....	.....	**2,640**
Mandan—				
1910	.....	.....	.....	26,400
Minot—				
1910	.....	.....	.....	13,200
Progress.	.....	.....	.....	2,640
1911	.....	.....	.....	**21,100**
Williston—				
1910	.....	.....	.....	14,640
1911	.....	.....	.....	**5,620**
OHIO.				
Akron—				
1910	5,280	.....	.....	85,400
Alliance—				
1910	.....	7,500	.....	3,500
Progress.	.....	.....	.....	2,000
Ashtabula—				
1910	.....	.....	.....	8,054
Progress.	.....	.....	.....	2,160
Bellefontaine—				
1910	.....	.....	.....	5,280
Progress.	.....	.....	.....	122,000
Bowling Green—				
1910	.....	.....	.....	1,500
1911	.....	.....	.....	**6,000**
Bucyrus—				
1910	.....	.....	.....	6,482
1911	**6,700**	.....	.....	**18,827**
Canal Dover—				
1911	.....	.....	.....	**10,560**
Carrollton—				
1910	.....	.....	.....	6,000
Celina—				
1910	.....	.....	.....	2,000
Cincinnati*—				
1910	7,700	.....	.....	58,600
Progress.	15,500	.....	.....	13,700
*2,000 feet of concrete sewer, with brick invert, constructed in 1910.				
Cleveland Heights—				
1910	.....	.....	.....	18,500
1911	.....	.....	.....	**10,560**
Columbus—				
1910	427,673	.....	31,551	1004723
Progress.	625	.....	1,100	8,000
Conneaut—				
1911	.....	.....	.....	**4,000**
Coshocton—				
1910	.....	.....	.....	2,640
Defiance—				
1910	2,640	.....	.....	.....
Delaware—				
1910	.....	.....	.....	2,640
Progress.	.....	.....	.....	3,325
1911	.....	.....	.....	**2,800**
E. Cleveland—				
1910	.....	.....	.....	3,960
1911	.....	.....	.....	**1,580**
E. Liverpool—				
1910	.....	.....	.....	528
1911	.....	.....	.....	**2,640**
Euclid—				
1910	.....	.....	.....	1,320
1911	.....	.....	.....	**2,640**
Findlay—				
1910	.....	.....	.....	4,000
1911	.....	.....	.....	**10,000**
Fostoria—				
Progress.	.....	.....	.....	5,333
Galion—				
1910	.....	.....	.....	41,346
Progress.	.....	.....	.....	8,658
1911	.....	.....	.....	**9,510**
Greenville—				
1910	.....	.....	.....	3,440
Ironton—				
1910	.....	3,100	.....	4,400
1911	.....	**6,200**	.....	**600**
Lancaster—				
1911	.....	.....	.....	**3,290**
Leetonia—				
1910	.....	.....	.....	7,000
Progress.	.....	.....	.....	3,000
1911	.....	.....	.....	**5,000**
Lorain—				
1910	4,423	.....	1,850	28,300
1911	**5,000**	.....	**2,000**	**20,000**
Louisville—				
1910	.....	.....	.....	31,800
1911	.....	.....	.....	**400**
Marietta—				
1910	.....	.....	.....	5,010
Progress.	.....	.....	.....	5,048
Miamisburg—				
1910	.....	1,320	.....	2,640
1911	.....	**2,640**	.....	.....
Millersburg—				
1910	.....	.....	.....	600
Progress.	.....	.....	.....	2,600
Napoleon—				
1910	.....	.....	.....	3,000
Niles—				
1910	.....	.....	.....	16,400
Progress.	.....	.....	.....	15,800
1911	.....	.....	.....	**52,800**
Norwalk—				
1910	.....	.....	4,300	7,900
Norwood—				
1910	.....	660	.....	660
Oberlin—				
1910	.....	.....	.....	2,000
Ravenna—				
1910	.....	.....	.....	1,500
1911	.....	.....	.....	**3,000**
Salem—				
1910	.....	.....	.....	2,000
Progress.	.....	.....	.....	3,000
1911	.....	.....	.....	**3,000**
Steubenville—				
1910	2,640	.....	.....	13,200
1911	**5,280**	.....	**5,280**	**15,800**
Toledo—				
1910	6,400	.....	.....	29,900
Wadsworth—				
1910	.....	.....	.....	3,616
Warren—				
1910	.....	.....	.....	2,640
Progress.	.....	.....	.....	18,500
Youngstown—				
1911	.....	.....	.....	**79,000**
Zanesville—				
1910	4,520	.....	.....	9,070
Progress.	.....	.....	.....	2,130
1911	.....	.....	.....	**6,000**
OKLAHOMA.				
Chandler—				
1910	.....	.....	.....	27,176
1911	.....	.....	.....	**16,997**
Clinton—				
1910	.....	.....	.....	31,600
Progress.	.....	.....	.....	10,560
1911	.....	.....	.....	**42,300**
El Reno—				
1910	.....	3,920	.....	.....
1911	.....	.....	**31,700**	.....
Enid—				
1910	5,280	5,280	5,280	105,600

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Guthrie—				
1910	3,152	5,112	.....	22,226
1911	.....	.....	.....	**15,000**
Lawton—				
Progress.	.....	4,000	.....	.....
1911	.....	**3,500**	.....	.....
Muskogee—				
1910	.....	.....	4,180	.....
1911	.....	.....	**45,000**	**45,000**
Norman—				
Progress.	.....	1,000	.....	.....
1911	.....	.....	.....	**15,800**
Shawnee—				
1910	.....	.....	.....	52,800
1911	.....	.....	.....	**52,800**
Tulsa*—				
1911	.....	.....	.....	**35,000**

*24,000 feet of concrete pipe sewer constructed in 1910.

Vinita—				
1910	.....	.....	.....	15,000
Progress.	.....	.....	.....	3,000
1911	.....	.....	.....	**12,000**

OREGON.

Albany—				
1910	.....	.....	.....	1,600
Progress.	.....	.....	.....	800
1911	.....	.....	.....	**20,100**
Cloquille—				
1911	.....	.....	.....	**10,560**
The Dalles—				
Progress.	.....	.....	.....	10,560
1911	**2,640**	.....	.....	**79,000**
Marshfield—				
1910	.....	.....	.....	15,800
1911	.....	.....	.....	**7,920**
Fortland—				
1910	487	31,983	.....	544,667
Salem—				
1910	.....	.....	3,200	8,000

PENNSYLVANIA.

Bellwood—				
1911—Complete system in prospect.				
Bloomsburg—				
1910	.....	.....	.....	600
Carbondale—				
1911	.....	.....	.....	**52,800**
Chambersburg—				
1910	.....	.....	179	4,098
Chester—				
Progress.	.....	.....	.....	13,600
Corry—				
1911	.....	.....	.....	**850**
Erie*—				
1910	.....	3,340	.....	11,163

*Will lay 3,000 feet of sewer in 1911, kind not yet decided.

Gallitzin—				
1910	.....	.....	.....	500
1911	.....	.....	.....	**1,000**
Harrisburg—				
1910	.....	.....	.....	7,415
Progress.	915	.....	.....	8,852
1911	.....	.....	.....	**25,600** **38,000**
Homestead—				
1910	.....	.....	.....	232
Ligonier—				
1911—Complete system.				
McKees Rock—				
1910	.....	.....	350	1,000
1911	.....	.....	.....	**2,000**
Minersville—				
1910	.....	.....	.....	300
Newcastle—				
1910	.....	.....	.....	5,290
1910	.....	.....	.....	**5,280**
Norristown—				
1910	.....	.....	.....	1,000
1911	.....	.....	.....	**2,500**
Northeast—				
1910	.....	.....	.....	7,940
Northumberland—				
1910	.....	.....	.....	4,562
Oil City—				
1910	.....	.....	1,975	7,484
1911	.....	.....	.....	**4,000**
Port Allegany—				
1911	.....	.....	.....	**2,000**
Pottsville—				
1910	.....	.....	.....	1,500
Reading*—				
1910	.....	.....	.....	1,800

*$247,800 will be spent on sewers in 1911.

Scottdale—				
1910	.....	.....	.....	10,560
Progress.	.....	.....	.....	10,560
Sharpsville—				
1911	.....	.....	.....	**10,560**
Somerset—				
1910	.....	.....	.....	2,500
Swissvale—				
1910	.....	.....	.....	2,450
1911	.....	.....	.....	**1,000**
Tyrone—				
1910	.....	.....	.....	2,700
Waynesboro—				

Constructed 900 feet of stone sewer in 1910.

Wilkes Barre—				
1910	1,500	.....	.....	2,017
Wilkinsburg—				
1910	10,560	.....	.....	174,000
1911	.....	.....	.....	**2,640**
Williamsport—				
1910	.....	.....	.....	2,298
1911	**3,350**	.....	.....	**3,900**

RHODE ISLAND.

E. Providence*—				
1910	7,920	.....	.....	84,500

*10,560 feet of sewer planned for 1911.

Pawtucket*—				
1910	1,217	618	.....	7,371

*1459 feet of vitrified pipe incased in concrete laid in 1910.

Providence—				
1910	19,200	.....	.....	14,200
Progress.	3,400	.....	.....	4,700
1911	**13,200**	.....	.....	**15,800**
Woonsocket—				
1910	.....	.....	.....	3,577

SOUTH CAROLINA.

Chester—				
1910	.....	.....	.....	2,000
Florence—				
1910	.....	.....	.....	105,600
Greenville—				
1910	.....	.....	.....	15,800
Progress.	.....	.....	.....	18,500
Rock Hill—				

$100,000 system to be built in 1911.

Union—				
1910	.....	.....	.....	23,800
Progress.	.....	.....	.....	800
1911	.....	.....	.....	**800**

SOUTH DAKOTA.

Aberdeen—				

Constructed complete system, costing $22,750, in 1910.

Faulkton—				
1910	.....	.....	.....	3,000
1911	.....	.....	.....	**1,500**
Lead—				
1910	.....	.....	.....	1,000
1911	.....	.....	.....	**3,000**
Lennox—				
1910	.....	.....	.....	27,000
1911	.....	.....	**9,000**	.....
Mitchell—				
1910	.....	.....	3,385	2,035
Progress.	.....	.....	.....	10,560
1911	.....	.....	.....	**10,560**
Pierre—				
1910	.....	.....	.....	750

Sioux Falls—Proposes to build 52,800 feet of sewer in 1911, kinds not yet determined.

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
TENNESSEE.				
Columbia—				
1910	.....	.....	.....	6,800
1911	.....	.....	.....	**7,000**
Knoxville*—				
1910	.....	.....	.....	8,418
*Constructed 195 feet cast iron sewer in 1910; proposes 26,400 feet of sewer in 1911, kinds not yet determined.				
Memphis—				
1910	.....	.....	.....	179,142
TEXAS.				
Belton—				
Progress.	.....	.....	.....	26,400
Denison—				
1910	.....	.....	.....	4,000
1911	.....	.....	.....	**10,000**
El Paso—				
1910	.....	.....	.....	8,400
Progress.	.....	660	.....	.....
1911	.....	**1,600**	.....	.....
Greenville—				
1910	.....	.....	.....	3,960
Texas City—				
1910	.....	.....	.....	10,560
1911	.....	.....	.....	**84,500**
UTAH.				
Ogden—				
1910	.....	.....	.....	28,200
1911	.....	**21,100**	.....	.....
Provo—				
1910	.....	.....	.....	52,800
Progress.	.....	.....	.....	36,900
1911	.....	.....	.....	**1,400**
Salt Lake City—				
1910	.....	.....	.....	190,521
1911	.....	.....	.....	**211,000**
VERMONT.				
Barre—				
1910	.....	.....	.....	6,532
Bellows Falls*—				
Progress.	.....	875	.....	500
*200 feet of iron sewer incased in concrete under contract.				
Chatham—				
1911—Complete System proposed.				
Fredericksburg—				
1910	.....	.....	.....	2,000
St. Albans—				
1910	.....	.....	.....	10,500
VIRGINIA.				
Danville—				
1910	.....	.....	.....	93,000
Richmond—				
$170,000 work in sewers being done. Budget for 1911 has not yet been adopted by City Council.				
WASHINGTON.				
Bellingham—				
1910	.....	8,887	5,100	11,646
Progress.	.....	2,157	.....	.....
1911	.....	**23,000**	.....	.....
Camp Washington—				
1910	.....	13,200	.....	6,400
1911	.....	.....	.....	**8,000**
Colfax—				
1910	.....	.....	.....	2,600
Everett—				
1910	.....	2,123	.....	18,798
Progress.	7,798	.....	2,971	25,454
Hoquiam*—				
1910	.....	.....	.....	48,000
Progress.	.....	.....	.....	5,600
1911	.....	.....	.....	**10,000**
*3,000 feet of box sewer constructed in 1910.				
Pullman—				
1910	.....	.....	.....	9,900
1911	.....	.....	.....	**5,000**
Puyallup—				
1910	.....	.....	.....	21,100
Seattle*—				
1910	.....	1,270	.....	12,900 217,000
*150 feet of creosoted wood stave sewer constructed in 1910.				
S. Yakima—				
1910	.....	.....	.....	2,500
Spokane—				
1910	.....	.....	.....	114,600
Progress.	.....	23,750	.....	.....
1911	.....	**26,400**	.....	**143,000**
Tacoma—				
1910	.....	39,758	3,485	160,248
Progress.	.....	6,072	8,712	19,008
1911	.....	.....	**8,712**	.....
Walla Walla—				
1910	.....	.....	.....	21,800
1911	.....	.....	.....	**30,000**
WEST VIRGINIA.				
Charleston—				
$94,000 sewer system constructed in 1910.				
Fairmont—				
1910	.....	.....	.....	2,640
1911	.....	.....	.....	**2,640**
Middlebourne—				
1911	.....	.....	.....	**3,000**
Wheeling—				
1910	.....	.....	.....	70,791
WISCONSIN.				
Appleton—				
1910	.....	600	.....	11,903
Beloit—				
1910	.....	.....	.....	13,200
1911	.....	.....	.....	**5,280**
Burlington—				
1910	.....	.....	.....	5,932
1911	.....	.....	.....	**4,300**
De Pere—				
1910	.....	.....	.....	2,750
Eau Claire—				
1910	.....	.....	.....	9,378
1911	.....	.....	.....	**900**
Fond du Lac—				
1910	.....	.....	.....	7,137
1911	.....	.....	.....	**10,560**
LaCrosse—				
1910	.....	.....	5,731	3,676
1911	.....	.....	.....	**5,280**
Milwaukee—				
1910	.....	11,647	.....	 39,249
1911	.....	**26,400**	.....	..... **36,960**
Oshkosh—				
1910	.....	.....	.....	10,828
1911	.....	.....	**650**	**9,500**
Portage—				
1910	.....	.....	.....	5,280
Progress.	.....	.....	.....	47,500
Racine—				
1910	.....	100	.....	2,000 10,560
Progress.	.....	.....	.....	1,600
Shawano—				
1911	.....	.....	.....	**16,176**
Watertown—				
1910	.....	.....	.....	1,655
1911	.....	.....	.....	**3,500**
Waupaca—				
1910	.....	.....	.....	4,178
1911	.....	.....	.....	**5,280**
Wausau—				
1911	.....	.....	**2,400**	.....
WYOMING.				
Laramie—				
1910	.....	.....	.....	2,640
1911	.....	.....	.....	**10,560**
CANADA.				
Kingston, Ont.—				
1910	.....	.....	.....	3,000
1911	.....	.....	.....	**2,000**
New Westminster, B. C.—				
1910	.....	45,000	.....	.....
Progress.	.....	.....	.....	75,000
1911	.....	.....	.....	**75,000**

Cities	Brick	Concrete	Reinforced Concrete	Vitrified Pipe
Swift Current, Sask.—				
1910.....	.....	.....	.....	10,560
1911.....	.....	.....	.....	**31,700**
Toronto, Ont.—				
1910.....	52,800	.....	.....	.....
Progress.	10,560	.....	.....	.....
1911.....	**63,500**	.....	.....	.....
Winnipeg, Man.—				
1910.....	.....	6,240	.....	78,400
Progress.	.....	12,600	.....	.....

SEWAGE DISPOSAL AND PUMPING PLANTS

CALIFORNIA.

Coalinga. A septic tank and filter bed will be built in 1911.

East San Jose. City completed septic tank and filter bed in 1911.

Fresno. A septic tank and 812 acre sewer farm were completed in 1910.

Portersville. The city completed 4 20x30 septic tanks, and installed a 130-acre sewer farm.

San Mateo. Two septic tanks are to be built in 1911.

Santa Clara. One septic tank, a centrifugal pump, and a filter were installed in 1910.

Santa Cruz. The city will build a septic tank in 1911.

CONNECTICUT.

New Haven. City completed sand filtration plant and ½-acre filter bed in 1910.

Wallingford. City will build complete disposal plant in 1911.

GEORGIA.

Atlanta. A disposal plant will be built, and two small sewage pumps purchased in 1911.

Eastman. Two 100,000-gallon sewage pumps will be purchased in 1911.

ILLINOIS.

Canton. One septic tank was completed in 1910, and one will be built in 1911.

Chicago. Four clearwater flushing sewage pumps of 250 c. f. s. were purchased in 1910.

Chicago Heights. Extensive repairs to disposal plant were completed in 1910.

Collinsville. In 1910, a septic tank, 29x62x8 was completed.

In 1911, two small tanks will be built.

Dekalb. Complete disposal plant will be built in 1911.

Freeport. One sewage pump will be purchased in 1911.

Galena. Four flush tanks were installed in 1910.

Granite City. One septic tank was completed in 1910.

LaGrange. In 1911, a filter plant and pumping station will be built.

Taylorville. A settling basin was completed in 1910.

INDIANA.

Hammond. One sewage pump was purchased in 1910.

Indianapolis. Two centrifugal sewage pumps were purchased in 1910.

IOWA.

Des Moines. Two septic tanks were completed in 1910.

Indianola. The city completed a settling tank in 1910.

In 1911, one settling tank will be built.

Pella. A $2,500 disposal plant was built in 1910.

Sigourney. Will build 3 sewage disposal plants in 1911.

KANSAS.

Burlington. One septic tank, with an electric sewage pump was installed in 1910.

Concordia. The city has a stormwater disposal, controlled by a system of 12 dams.

Holton. Four 6x10 Adams feed time syphons are being installed.

Manhattan. Eight volute vertical motor-driven sewage pumps are being installed.

Olathe. A sewage disposal plant will be built in 1911.

Pratt. A septic tank was built in 1910.

Wellington. A disposal plant, or improvements to present system, will be put in operation in 1911.

MARYLAND.

Annapolis. Plans are being prepared for complete disposal system.

MASSACHUSETTS.

Easthampton. A ¼-acre sludge bed was completed in 1910.

Greenfield. A screen house is being built.

MICHIGAN.

Cadillac. A sewage pumping station is being built.

MINNESOTA.

Bemidji. A settling chamber was completed in 1910.

New Ulm. A septic tank and filter were completed in 1910.

St. Paul. In connection with sewer work in this city, 5914 ft. of sand rock tunnel was driven.

MISSOURI.

Nevada. A septic tank and filter bed will be built in 1911.

Sedalia. A $14,000 disposal plant will be built in 1911.

NEW JERSEY.

Elizabeth. Three 2,000 gal. per minute pumps were installed in 1910.

Millville. One small centrifugal pump was purchased in 1910.

Plainfield. The present pneumatic ejector plant is to be enlarged in 1911.

NEW YORK.

Batavia. A $375,000 sewerage system is under construction.

Oneida. One complete disposal plant will be built in 1911.

NORTH DAKOTA.

Mandan. One highwater sewage pump has been contracted for.

OHIO.

Akron. Plans have been prepared for a $300,000 disposal plant.

Bellefontaine. An automatic syphon system and filtration field are contemplated for 1911.

Bucyrus. Four settling tanks, 6 filter beds, ½-acre sprinkling filter, and 2 sewage pumps are included in the system to be built in 1911.

Delaware. Disposal plant will be built in the spring of 1911.

Fostoria. City is remodeling its present disposal plant.

Louisville. The contracts are let for a complete disposal plant and one sewage pump.
Niles. A disposal plant, with all accessories, will be built in 1911.
Oberlin. The city completed a disposal plant in 1910.
Salem. The State Board of Health has ordered the construction of a disposal plant.
Wadsworth. A $17,953 plant, including 4 sewage pumps, was completed in 1910.
Youngstown. Plans are prepared for 2 disposal plants, which will be constructed in 1911.

OKLAHOMA.

Chandler. The city completed a $3,500 disposal plant.
Muskogee. The city will build a $10,000 disposal plant in 1911.
Norman. The city completed a septic tank, and installed 7 Miller-Potts automatic syphon flush tanks in 1910.
In 1911, one 500,000-gallon pump will be purchased.

OREGON.

The Dalles. Plans are prepared for a complete disposal plant.

PENNSYLVANIA.

Carbondale. A disposal plant will be built in 1911.
Chambersburg. Plans for a disposal plant and trunk sewer have been prepared.
Corry. A disposal plant is contemplated for 1911.
Doyleston. Septic tanks and filter beds were completed in 1910.
Franklin. A complete disposal plant will be constructed in 1911.
Ligonier. A sedimentation tank, sprinkling filters, and one sewage pump will be installed in 1911.
Norristown. A complete disposal plant will be constructed in 1911.
Northeast. A sewage disposal plant will be built in 1911.

SOUTH CAROLINA.

Florence. A disposal plant is under construction.

SOUTH DAKOTA.

Mitchell. A complete disposal plant will be built in 1911.

TENNESSEE.

Memphis. The following additions to the sewage disposal system were completed in 1910:
One 7½ h. p., and one 15 h. p. electric motor, direct connected to 3-inch and 4-inch pumps, and two 20-inch, 150 h. p. pump, one 24-inch, 175 h. p. pump, and one 8-inch, 50 h. p. pump.

TEXAS.

Belton. A sewage disposal plant is being constructed.
Dallas. A $550,000 bond issue has been passed for the construction of a disposal plant. Two sewage pumps will be purchased in 1911.
El Paso. A disposal plant will be built in 1911.
Texas City. Two sewage pumps will be purchased in 1911.

UTAH.

Ogden. A complete disposal plant will be constructed in 1911.

VERMONT.

Fredericksburg. A water power plant is being constructed.

WASHINGTON.

Pullman. A septic tank was completed in 1910.

WISCONSIN.

Beloit. A disposal plant for a new district will be built in 1911.
Portage. The city completed a disposal plant in 1910.
Waupaca. One septic tank, 14x95, was constructed in 1910.

CANADA.

Toronto, Ontario. The city completed a septic tank and contact beds, and installed 2 sets of motor-driven pumps in 1910.
In 1911, a disposal system for the entire city, with duplicate motor-driven pumps, will be constructed.

WATER WORKS IMPROVEMENTS

Official Reports of Water Works Improvements Made to Municipal Engineering by the Managers of the Water Works Plants of America

Arranged alphabetically by states and cities.

In the line "1910" under each city is given the number of linear feet of each kind of water pipe laid in the year 1910.

In the line "Progress" is given the number of linear feet of each kind of water pipe now under contract.

In the line "1911" is given the number of linear feet of each kind of water pipe proposed for construction in 1911, printed in heavy type so that it can be distinguished readily.

ALABAMA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Dothan—				
1910.....	15,800	.....	.....	.....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Talladega—				
1910.....	10,000	.....	.....	.....

ARKANSAS.

Arkansas City—				
1910.....	4,000	7,000	.....	.....
Batesville—				
Extensions of water mains proposed for 1911.				
Ft. Smith*—				
1910.....	60,000	.....	.....	.....

* City has taken over plant from private company.

CALIFORNIA.

Antioch—				
1911.....	**1,500**	.....	.....	.....
Lodi—				
1910.....	31,700	.....	.....	.....
Oceanside—				
Progress.	10,350	.....	.....	.....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Palo Alto—				
1910.....	7,367	.....	.....	.....
1911.....	**5,000**	.....	.....	.....
Portersville—				
1910.....	5,000	.....	.....	.....
1911.....	**45,000**	.....	.....	.....
San Bernardino—				
1910.....	15,800	.....	.....	.....
San Diego—				
1910.....	50,530	91,450	.....	.....
Progress.	15,312	11,616	.....	.....
1911.....	**39,072**	**77,088**	.....	.....
Santa Clara—				
1910.....	5,280	5,280	.....	.....
Minor extensions in 1911.				
Santa Cruz—				
1910.....	8,372	4,310	.....	.....
Visalia—				
1910.....	.....	4,000	.....	.....
COLORADO.				
Rocky Ford—				
1910.....	.....	373	.....	.....
Progress.	300	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
CONNECTICUT.				
Meriden—				
1910.....	9,500	.....	.....	.....
S. Norwalk—				
1910.....	1,937	.....	.....	.....
Terryville—				Galvanized
1910.....	3,500	.....	.....	1,200
Wallingford—				
1911.....	**1,500**	.....	.....	.....
FLORIDA.				
Jacksonville—				Galvanized
1910.....	21,351	.....	.....	24,945
Miami—				
1910.....	84,500	.....	.....	.....
GEORGIA.				
Americus—				
1911.....	**10,560**	.....	.....	.....
Atlanta—				
1910.....	216,480	.....	.....	.....
1911.....	**158,400**	.....	.....	.....
Cordelay—				
1910.....	3,500	.....	.....	.....
Eastman—				
1911.....	.....	**13,200**	**10,560**	.....
Valdosta—				
1910.....	5,300	.....	.....	.....
Wrightsville—				
1910.....	10,560	.....	.....	.....
Progress.	.....	10,560	.....	.....
IDAHO.				
Lewiston—				
1911.....	.....	.....	.....	**10,560**
Payette—				
1911.....	.....	.....	**15,000**	.....
ILLINOIS.				
Aurora—				Lead
1910.....	36,639	145	.....	50
Canton—				
1910.....	7,940	.....	.....	.....
1911.....	**7,940**	.....	.....	.....
Chicago Heights—				
1910.....	10,000	.....	.....	.....
1911.....	**15,000**	.....	.....	.....
Collinsville—				
1910.....	10,560	.....	.....	.....
Decatur—				
1910.....	.....	25,000	.....	.....
Dekalb—				
1910.....	5,000	.....	.....	.....
Elgin—				
1910.....	7,237	.....	.....	.....
Eureka—				
1910.....	7,960	.....	.....	.....
1911.....	**3,960**	.....	.....	.....
Galena—				
1910.....	28,950	.....	.....	.....
Galesburg—				
1910.....	11,750	.....	.....	.....
1911.....	**10,560**	.....	.....	.....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Joliet—				
1910.....	1,840	.....	.....	.....
1911.....	**4,000**	.....	.....	.....
LaGrange—				
1910.....	500	.....	.....	.....
Mattoon—				
1911.....	**2,700**	.....	.....	.....
Moline—				
1910.....	15,300	.....	.....	.....
Progress.	7,940	.....	.....	.....
Morton—				
1910.....	3.000	.....	.....	.....
Moweaqua—				
1910.....	.....	.....	10,560	.....
Oak Park—				
1910.....	23,600	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Ottawa—				
1910.....	1,600	.....	.....	.....
Paris—				
1910.....	2,600	.....	.....	.....
Paxton—				
1910.....	3,960	.....	.....	.....
1911.....	**5,000**	.....	.....	.....
Petersburg—				
1910.....	2,500	.....	.....	.....
Quincy—				
1910.....	10,560	.....	.....	.....
Rockford—				
1910.....	30,000	.....	.....	.....
1911.....	**50,000**	.....	.....	.....
Rock Island—				
1910.....	12,100	.....	.....	.....
Progress.	3,600	.....	.....	.....
1911.....	**4,400**	.....	.....	.....
Taylorville—				
1910.....	10,560	.....	.....	.....
Waukegan—				
1910.....	11,200	.....	.....	.....
INDIANA.				
Anderson—				
1910.....	10,544	500	.....	.....
Bloomington—				
1910.....	84,500	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Brazil—				
1910.....	3,000	.....	.....	.....
1911.....	**1,500**	.....	.....	.....
Butler—				
1911.....	**1,000**	.....	.....	.....
Columbia City—				
1910.....	2,640	.....	.....	.....
1911.....	**1,320**	.....	.....	.....
Columbus—				
1911.....	**2,640**	.....	.....	.....
E. Chicago—				
1910.....	7,558	.....	.....	.....
Elkhart—				
1911.....	**21,390**	.....	.....	.....
Evansville—				
1910.....	21,100	.....	.....	.....
Ft. Wayne—				
1910.....	18,400	.....	.....	.....
1911.....	**36,900**	.....	.....	.....
Hammond—				
1910.....	16,925	.....	.....	.....
1911.....	**3,600**	.....	.....	.....
Huntington—				
1910.....	5,200	.....	.....	.....
Indianapolis—				
1910.....	52,800	.....	.....	.....
1911.....	**52,800**	.....	.....	.....
Lafayette—				Service Attachments
1910.....	5,600	.....	.....	154
1911.....	.....	.....	.....	**150**
Logansport—				
1910.....	211,000	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Marion—				
1910.....	53,000	.....	.....	.....
1911.....	**1,580**	.....	.....	.....
Martinsville—				
1910.....	1,320	.....	.....	.....
Michigan City—				
1910.....	.....	7,940	.....	.....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Mishawaka—				
1910.....	9,767	.....	.....	.....
Noblesville—				
1910.....	50,145	6,000	.....	.....
Remington—				
1911.....	.....	**600**	.....	.....
Rushville—				
1910.....	10,560	5,280	.....	.....
Progress.	5,280	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Sullivan—				
1910.....	500	.....	.....	.....
Tipton—				
1910.....	.....	1,000	.....	.....
1911.....	.....	**1,000**	.....	.....
IOWA.				
Albia—				
1910.....	2,000	.....	.....	.....
Ames—				
1910.....	2,200	.....	.....	.....
Belle Plaine—				
1910.....	.....	.....	.....	26,400
Burlington—				
1910.....	17,100	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Cedar Falls—				
1910.....	6,600	.....	.....	.....
Cedar Rapids—				
1910.....	9,000	.....	.....	.....
Progress.	2,000	.....	.....	.....
Charles City—				
1910.....	21,100	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Des Moines—				
1910.....	137	.....	.....	.....
Eldora—				
1910.....	2,510	.....	.....	.....
1911.....	**1,000**	.....	.....	.....
Ft. Dodge—				
1910.....	10,560	.....	.....	.....
Glenwood—				
1910.....	400	.....	.....	.....
Grinnell—				
1910.....	2,000	.....	.....	.....
Indianola—				
1910.....	21,100	.....	.....	.....
Mason City—				
1910.....	13,200	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Mt. Pleasant—				
1910.....	4,350	.....	.....	.....
1911.....	**3,000**	.....	.....	.....
Muscatine—				
1910.....	15,800	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Newton—				
1910.....	300	.....	.....	.....
Pella—				
Constructed $60,000 plant in 1910.				
Sioux City—				
1910.....	25,509	400	.....	10,500
Waterloo—				
1910.....	74,000	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Webster City—				
1910.....	2,500	.....	.....	.....
1911.....	**3,000**	.....	.....	.....
KANSAS.				
Abilene—				
Progress.	74,000	13,200	.....	.....
Arkansas City—				
1910.....	3,960	.....	.....	.....
1911.....	**79,100**	.....	.....	.....
Burlington—				
1911.....	**33,000**	.....	.....	.....
Chanute—				
1910.....	11,000	.....	.....	.....
Cherryvale—				
1911.....	**36,900**	.....	.....	.....
Clay Center—				
1910.....	.....	1,000	.....	.....
Progress.	.....	900	.....	.....
Coffeyville—				
1910.....	15,000	5,000	.....	.....
1911.....	**20,000**	**5,000**	.....	.....
Emporia—				
1910.....	3,960	.....	.....	.....
1911.....	**3,850**	.....	.....	.....
Holton—				
1910.....	700	3,000	.....	.....
Manhattan—				
1910.....	8,800	8,000	.....	.....
Newton—				
Progress.	5,000	.....	.....	.....
Olathe—				
1910.....	1,000	.....	.....	.....
Ottawa—				
1910.....	4,400	.....	.....	.....
Pratt—				
1910.....	18,672	.....	.....	.....
Salina—				
1910.....	.....	18,000	.....	.....
Topeka—				
1910.....	13,200	.....	.....	.....
Progress.	1,900	.....	.....	.....
1911.....	**15,800**	.....	.....	.....
Wellington—				
1910.....	10,560	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
KENTUCKY.				
Ashland—				
1910.....	5,280	.....	.....	.....
Earlington—				
Progress.	3,200	.....	.....	.....
Louisville—				
1910.....	57,000	.....	.....	.....
1911.....	**95,100**	.....	.....	.....
LOUISIANA.				
Opelousas—				
Progress.	.....	1,800	.....	.....
1911.....	.....	**2,630**	.....	.....
MAINE.				
Augusta—				
1910.....	3,441	1,774	.....	.....
1911.....	**2,500**	**1,500**	.....	.....
Calais—				
1910.....	.....	1,800	.....	.....
MARYLAND.				
Baltimore—				
1911—27 tons of cast iron pipe.				
Cumberland—				
James H. Fuertes is investigating for proposed $500,000 water supply system, which will be voted on shortly.				
Pocomoke—				
Progress.	5,000	.....	.....	.....
Proposed new wells to reinforce present supply.				
MASSACHUSETTS.				
Attleboro—				Cement lined
1910.....	14,676	.....	.....	4,201
Progress.	3,500	.....	.....	.....
1911.....	**10,000**	.....	.....	**3,000**
Easthampton—				
1910.....	18,000	.....	.....	.....
1911.....	**15,000**	.....	.....	.....
Everett—				
1910.....	1,790	.....	.....	.....
Greenfield—				
Progress.	5,280	.....	.....	.....
Lowell—				
1910.....	10,700	.....	.....	.....
Medford—				
1910.....	8,167	.....	.....	.....
Quincy—				Cement
1910.....	18,480	.....	.....	18,480
Reading—				
1910.....	2,000	5,460	.....	.....
Revere—				
1910.....	8,610	.....	.....	.....
1911.....	**7,920**	.....	.....	.....
Springfield—				
1910.....	52,148	.....	.....	.....
1911.....	**40,000**	.....	.....	.....
Webster—				
1910.....	3,500	.....	.....	.....
Worcester—				
1910.....	52,800	.....	.....	.....

MICHIGAN.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Alpena—				Galvanized
1910	.....	.....	5,125	3,300
Battle Creek—				
1910	15,800	.....	.....	.....
1911	**15,800**	.....	.....	.....
Belding—				
1910	2,694	.....	.....	.....
1911	**1,600**	.....	.....	.....
Escanaba—				
1910	5,280	.....	.....	.....
1911	**5,280**	.....	.....	.....
Flint—				
1911	**105,600**	.....	.....	.....
Gladwin—				
1910	.....	.....	800	.....
1911	.....	.....	**800**	.....
Grand Rapids—				
1910	32,267	.....	.....	.....
Greenville—				
1910	54,646	.....	.....	.....
Harbor Springs—				
Progress.	15,800	.....	.....	.....
Highland Park—				
1910	24,205	.....	.....	.....
1911	**6,047**	.....	.....	.....
Jackson—				
1910	29,000	.....	.....	.....
1911	**15,800**	.....	.....	.....
Kalamazoo—				
1911	**43,000**	.....	.....	.....
Lake City—				
1910	.....	.....	400	.....
1911	.....	.....	**300**	.....
Lansing—				
1910	10,560	.....	.....	.....
Manistique—				
1910	1,200	.....	.....	.....
Marine City—				
1910	400	.....	.....	.....
Marshall—				
1910	1,550	.....	.....	.....
Mt. Clemens—				
1910	2,640	.....	.....	.....
Norway—				
1910	111,000	.....	.....	.....
1911	**2,700**	.....	.....	.....
Port Huron—				
1910	5,290	.....	.....	.....
Rochester—				
1911	**2,500**	.....	.....	.....
Saginaw—				Cement
1910	13,200	.....	.....	.....
Progress.	.....	.....	.....	1,200
Sault Ste. Marie—				
1910	300	.....	.....	.....
Three Rivers—				
1910	2,640	.....	.....	.....
1911	**2,640**	.....	.....	.....
Whitehall—				
1910	800	2,000	.....	.....
1911	**400**	.....	.....	.....
Wyandotte—				
1910	400	.....	.....	.....

MINNESOTA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Amboy—				Galvanized
1910	.....	.....	.....	1,320
Bemidji—				
1910	2,400	.....	.....	.....
1911	.....	**1,200**	.....	.....
Cloquet—				
1910	7,000	.....	.....	.....
1911	**10,000**	.....	.....	.....
Crookston—				
1910	11,420	.....	.....	.....
1911	**1,000**	.....	.....	.....
Duluth—				
1910	46,166	.....	.....	.....
1911	**102,312**	.....	.....	.....
Faribault—				
1910	3,906	.....	.....	.....
1911	**3,000**	.....	.....	.....
Hastings—				
1910	1,182	.....	.....	.....
Progress.	3,000	1,045	.....	.....
1911	.....	**1,500**	.....	.....
Madelia—				
1911	**2,800**	.....	.....	.....
Mankato—				
1910	4,355	.....	.....	.....
Minneapolis—				
1910	210,200	.....	.....	.....
Montevideo—				
1910	6,700	.....	.....	.....
1911	**400**	.....	.....	.....
New Ulm—				
1910	1,280	.....	.....	.....
Progress.	1,250	.....	.....	.....
1911	**860**	.....	.....	.....
Red Wing—				
1910	2,000	.....	.....	.....
1911	.....	.....	.....	**2,640**
St. Cloud—				
1911	**2,640**	.....	.....	.....
St. Paul—				Cement
1910	13,625	6,792	.....	2,100
1911	**52,800**	.....	.....	.....
St. Peter—				
1911	**3,000**	.....	.....	.....
Virginia—				
1910	21,100	.....	.....	.....
1911	**10,560**	.....	.....	.....
Winona—				
1910	1,780	.....	.....	.....
Worthington—				
1911	**6,000**	.....	.....	.....

MISSISSIPPI.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Clarksdale—				
1910	1,000	.....	.....	.....
1911	**2,600**	.....	.....	.....
Hattiesburg—				
1911	**10,000**	.....	.....	.....
Yazoo City—				
1910	4,800	.....	.....	.....

MISSOURI.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Aurora—				
Progress.	10,560	.....	.....	.....
1911	**5,280**	.....	.....	.....
Brookfield—				
1910	19,800	.....	.....	.....
1911	**2,640**	.....	.....	.....
Fulton—				
1910	1,724	.....	.....	.....
1911	**2,640**	.....	.....	.....
Glasgow—				
1911	**1,200**	.....	.....	.....
Kansas City—				
1910	80,600	.....	.....	.....
Progress.	71,400	.....	.....	.....
1911	**158,000**	.....	.....	.....
Lebanon—				
1911	.....	**15,800**	.....	.....
Libertyville—				
1910	12,000	.....	.....	.....
Louisiana—				Galvanized
1910	.....	.....	.....	400
1911	**600**	.....	.....	**1,000**
Moberly—				

1911—$50,000 improvements to municipal plant, mains, pumps, engines, etc.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Tarkio—				
1910	.....	2,640	.....	.....

MONTANA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Bozeman—				
1910	640	.....	2,700	.....
1911	.....	.....	**4,500**	.....
Deer Lodge—				
1910	21,100	.....	31,700	.....
1911	**2,000**	.....	**3,000**	.....
Glasgow—				
1910	58,000	.....	2,640	.....
Great Falls—				
1910	6,794	.....	.....	.....
1911	**12,000**	.....	.....	.....
Helena—				Steel
1911	**228,036**	.....	**112,415**	**430**
Lewistown—				
1910	3,000	.....	.....	.....
1911	**50,000**	.....	.....	.....

NEBRASKA.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Chadron—				
1910.....	2,700	.....	.....	.....
1911.....	**8,000**	.....	.....	.....
Columbus—				
1911.....	**15,800**	.....	.....	.....
Hastings—				
1911.....	**10,560**	.....	.....	.....
Lincoln—				
1910.....	19,500	.....	.....	.....
1911.....	**21,100**	.....	.....	.....
Norfolk—				
1910.....	5,800	.....	.....	.....
1911.....	**3,000**	.....	.....	.....
Red Cloud—				Vitrified
1911.....	**1,500**	.....	.....	**9,500**
Tecumseh—				
1910.....	10,560	.....	.....	.....
University Place—				
1911.....	**3,000**	.....	.....	.....
Wymore—				
1911.....	**13,500**	.....	.....	.....

NEVADA.

Reno—				
1910.....	.....	1,352	.....	.....
1911.....	.....	**10,560**	.....	.....

NEW HAMPSHIRE.

Keene—				
1910.....	6,012	.....	.....	.....
Littleton—				
1910.....	6,470	.....	.....	.....
Raymond—				
1910.....	350	.....	.....	.....

NEW JERSEY.

Atlantic City—				
1910.....	12,000	.....	25,000	.....
1911.....	**20,000**	.....	.....	.....
Bayonne—				
1910.....	6,440	.....	.....	.....
Bloomfield—				
1910.....	26,400	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Garfield—				
1910.....	21,100	.....	.....	.....
Irvington—				
1911—Municipal plant being considered.				
Jersey City—				
1910.....	11,774	.....	.....	.....
Millville—				
1910.....	10,560	.....	.....	.....
Montclair—				
1910.....	12,331	.....	.....	.....
Newark—				
1910.....	49,100	.....	.....	.....
New Brunswick—				
1910.....	11,987	.....	.....	.....
Nutley—				
1910.....	13,200	.....	.....	.....
1911.....	**1,700**	.....	.....	.....
Ocean City—				
1910.....	15,800	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Perth Amboy—				
1910.....	13,400	.....	.....	.....
1911.....	**15,000**	.....	.....	.....
Rutherford—				
1911.....	.....	.....	.....	**5,280**

NEW YORK.

Albany—				
1910.....	21,100	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Amsterdam—				
1910.....	7,770	.....	.....	.....
Auburn—				
1910.....	2,640	.....	.....	.....
Batavia—				
1911.....	**500**	.....	.....	.....
Binghamton—				
1911.....	.....	**10,560**	.....	.....
Buffalo—				
1910.....	43,556	.....	.....	.....
Progress.	26,400	.....	.....	.....
1911.....	**52,800**	.....	.....	.....
Corning—				
1910.....	2,400	.....	.....	.....
Dunkirk—				
1910.....	10,560	.....	.....	.....
Progress.	5,280	.....	.....	.....
Elmira—				
1910.....	10,000	.....	.....	.....
1911.....	**19,800**	.....	.....	.....
Herkimer—				
1910.....	1,357	.....	.....	.....
Huntington—				
1910.....	7,749	.....	.....	.....
1911.....	**11,100**	.....	.....	.....
Jamestown—				
1910.....	7,640	6,458	.....	.....
Keeseville—				
1911.....	**5,300**	.....	.....	.....
Little Falls—				
1911.....	**2,500**	.....	.....	.....
Little Valley—				
1911.....	**42,200**	.....	.....	.....
Millerton—				Cement conduit
1911.....	**3,000**	.....	.....	**300**
Newark—				
1911.....	**4,200**	.....	.....	.....
Niagara Falls—				
1910.....	36,300	.....	.....	.....
Olean—				
1910.....	21,100	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Oneida—				
1910.....	1,320	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Plattsburg—				
1910.....	2,400	.....	.....	.....
1911.....	**10,000**	.....	.....	.....
Potsdam—				
1910.....	3,500	.....	.....	.....
Rome—				Cement
1910.....	31,700	.....	.....	31,700
Salamanca—				
1910.....	4,230	.....	.....	.....
1911.....	**6,340**	.....	.....	.....
Seneca Falls—				
1910.....	24,059	.....	.....	.....
Progress.	900	.....	.....	.....
Solvay—				
1190.....	1,000	.....	.....	.....
1911.....	**500**	.....	.....	.....
Syracuse—				
1911.....	**26,400**	.....	.....	.....
Troy—				
1910.....	10,000	.....	.....	.....
1911.....	**10,000**	.....	.....	.....
White Plains—				
1910.....	1,000	.....	.....	.....
Progress.	.....	1,000	.....	.....
1911.....	**300**	.....	.....	.....

NORTH CAROLINA.

Asheville—				
1910.....	5,280	.....	.....	.....
Greensboro—				
1910.....	10,560	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Greenville—				Cement
1910.....	2,000	.....	1,000	200
1911.....	**1,000**	.....	.....	.....
Hendersonville—				
1910.....	13,200	21,100	.....	.....
Progress.	.....	10,560	.....	.....
Raleigh—				
1910.....	2,500	.....	.....	.....
Wilmington—				
1910.....	78,400	.....	.....	.....
Wilson—				
1911.....	**2,000**	.....	.....	.....

NORTH DAKOTA.

Bismarck—				
1910.....	5,000	.....	.....	.....
Grand Forks—				Cement lined
1910.....	3,132	.....	.....	.....
1911.....	.....	.....	.....	**10,560**
Jamestown—				
1910.....	2,640	.....	.....	.....
Progress.	5,280	.....	.....	.....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Mandan—				
1910.....	6,000	.....	.....	.....
1911.....	**31,700**	.....	.....	.....
Minot—				
1910.....	61,136	.....	.....	.....
Wahpeton—				
1910.....	800	.....	.....	.....
1911.....	**2,500**	.....	.....	.....
Williston—				
1910.....	23,241	.....	.....	.....
1911.....	**2,660**	.....	.....	.....
OHIO.				
Alliance—				
1910.....	8,000	2,000	.....	.....
1911.....	**4,000**	**1,000**	.....	.....
Bellefontaine—				
1910.....	6,600	.....	.....	.....
1911.....	**1,320**	.....	.....	.....
Bowling Green—				
1910.....	1,000	.....	.....	.....
Bucyrus—				
1910.....	4,000	.....	10,560	.....
Cadiz—				
1910.....	.....	8,600	.....	.....
Canal Dover—				
1911.....	**2,800**	.....	.....	.....
Carrolton—				
1910.....	1,700	.....	.....	.....
Cincinnati—				
1910.....	95,500	.....	.....	.....
Cleveland—				
1910.....	105,600	.....	.....	.....
1911.....	**105,600**	.....	.....	.....
Cleveland Heights—				
1910.....	15,800	.....	.....	.....
1911.....	**10,560**	.....	.....	.....
Coshocton—				
1910.....	1,580	.....	.....	.....
Defiance—				
1910.....	2,500	.....	.....	.....
Delaware—				
1911.....	**2,640**	.....	.....	.....
E. Cleveland—				
1910.....	5,280	.....	.....	.....
1911.....	**3,960**	.....	.....	.....
E. Liverpool—				
1910.....	1,500	.....	.....	.....
1911.....	**2,000**	.....	.....	.....
Elyria—				
1910.....	26,000	.....	.....	.....
Euclid—				
1910.....	21,100	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Galion—				
1910.....	5,280	.....	.....	.....
1911.....	**2,640**	.....	.....	.....
Greenville—				
1910.....	1,350	.....	.....	.....
Leetonia—				
1911.....	**1,320**	.....	.....	.....
Lorain—				
1910.....	15,800	.....	.....	.....
1911.....	**21,100**	.....	.....	.....
Millersburg—				
1910.....	1,800	.....	.....	.....
Niles—				
1910.....	10,560	.....	.....	.....
Progress.	24,300	.....	.....	.....
Norwalk—				
1910.....	2,640	.....	.....	.....
1911.....	**7,920**	.....	.....	.....
Norwood—				
1910.....	2,500	2,640	.....	.....
1911.....	**2,000**	.....	.....	.....
Ravenna—				
1910.....	2,000	.....	.....	.....
Reading—				
1910.....	3,000	.....	.....	.....
Steubenville—				
1910.....	5,280	.....	.....	.....
1911.....	**5,280**	.....	.....	.....
Toledo—				
1910.....	58,340	.....	.....	.....
1911.....	**900 tons**	.....	.....	.....
Warren—				
1910.....	15,840	.....	.....	.....
Progress.	5,280	.....	.....	.....
West Carrollton—				
1911.....	**3,000**	.....	.....	.....
Youngstown—				
1910.....	10,560	.....	.....	.....
Zanesville—				
1910.....	4,800	.....	.....	.....
1911.....	**4,100**	.....	.....	.....
OKLAHOMA.				
Clinton—				
1910.....	15,800	.....	.....	.....
1911.....	**52,800**	.....	.....	.....
El Reno—				
1911.....	**79,200**	.....	.....	.....
Enid—				
1910.....	52,800	.....	.....	.....
Guthrie—				
1910.....	18,000	.....	.....	.....
1911.....	**16,000**	.....	.....	.....
Lawton—				
1910.....	63,500	.....	.....	.....
Progress.	15,800	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Muskogee—				
1910.....	24,160	.....	.....	.....
Progress.	3,200	.....	.....	.....
1911.....	**35,000**	.....	.....	.....
Oklahoma City—				
1910.....	158,000	.....	.....	.....
Shawnee—				
Progress.	26,400	.....	.....	.....
Tulsa—				
1911.....	**25,000**	.....	.....	.....
Vinita—				Galvanized
1910.....	.....	.....	.....	50,000
1911.....	.....	.....	.....	**40,000**
OREGON.				
Cloquille—				
1911.....	.....	.....	**21,100**	.....
The Dalles—				
1910.....	1,500	.....	600	.....
PENNSYLVANIA.				
Altoona—				
1910.....	12,270	.....	.....	.....
1911.....	**12,270**	.....	.....	.....
Bellwood—Minor extensions.				
Bradford—				
1911.....	**4,000**	.....	.....	.....
Chambersburg—				
1910.....	2,000	.....	.....	.....
Progress.	55,400	.....	.....	.....
Dalton—System being put in.				
Doyleston—				
1911.....	**1,000**	.....	.....	.....
Erie—				
1910.....	28,502	.....	.....	.....
Galitzin—Preliminary surveys being made.				
Harrisburg—				
1910.....	28,384	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
Huntington—				
1910.....	5,800	.....	.....	.....
Ligonier*—				
1911.....	.....	.....	**8,405**	**4,212**
*Cement lined pipe, 202 ft.; cement pipe, 570 ft.; others, 3,440 ft.				
McKees Rock—				
1910.....	500	.....	.....	.....
1911.....	**1,500**	.....	.....	.....
Northeast—				
1910.....	105,600	.....	.....	.....
Oil City—				
1910.....	2,900	.....	.....	.....
Scottdale—				
1910.....	15,800	.....	.....	.....
Progress.	15,800	.....	.....	.....
1911.....	**52,800**	.....	.....	.....
Somerset—				
Progress.	4,600	.....	.....	.....
Waynesboro—				
1910.....	1,600	3,960	.....	.....

RHODE ISLAND.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Pawtucket—				
1910.....	25,500	8,350	.....	.....
Providence—				
1910.....	27,800	.....	.....	.....
Rumford—				
1910.....	2,640	3,000	.....	.....

SOUTH CAROLINA.

Chester—				
1910.....	4,000	.....	.....	.....
Florence—				
1910.....	34,300	.....	.....	.....
Union—				
1910.....	63,400	.....	.....	.....
Progress.	2,640	.....	.....	.....
1911.....	**2,640**	.....	.....	.....

SOUTH DAKOTA.

Aberdeen—				
1910.....	13,941	.....	.....	.....
Faulkton—				
1910.....	1,000	.....	.....	.....
1911.....	**1,000**	.....	.....	.....
Flandreau—				
1910.....	1,500	.....	.....	.....
Lennox—				
1910.....	6,400	.....	.....	.....
Progress.	2,200	.....	.....	.....
1911.....	**3,000**	.....	.....	.....
Minot—				
1910.....	.....	591,360	.....	.....
Pierre—				
1910.....	5,280	.....	.....	.....
1911.....	**7,920**	.....	.....	.....
Rapid City—				
1910.....	6,000	.....	21,100	.....
Sioux Falls—				
1910.....	31,700	.....	.....	.....
1911.....	**10,560**	.....	.....	.....

TENNESSEE.

Cleveland—				
1911.....	**4,500**	.....	.....	.....
Columbia—				
1910.....	3,000	.....	.....	.....
Knoxville—				
1910.....	15,073	1,850	.....	.....
1911.....	**20,000**	**2,000**	.....	.....
Nashville—				
1910.....	37,573	.....	.....	.....
Paris—				
1910.....	21,000	.....	.....	.....
1911.....	**1,000**	.....	.....	.....

TEXAS.

Belton—				
Progress.	3,700	.....	.....	.....
Dallas—				
Progress.	*11,000	.....	.....	.....
*Tons.				
Denison—				
1910.....	6,000	15,000	.....	.....
Progress.	20,000	.....	.....	.....
1911.....	**8,000**	.....	.....	.....
El Paso—				
Progress.	26,400	.....	.....	.....
1911.....	**31,680**	.....	.....	.....
Greenville—				
1910.....	2,640	10,560	.....	.....
San Antonio—				Cement
1910.....	79,200	.....	.....	.....
Progress.	500	2,000	1,000	.....
1911.....	.....	.....	**25,000**	**25,000**
San Marcos—				
1910.....	15,000	.....	.....	.....
1911.....	**6,000**	.....	.....	.....
Texas City—				
1911.....	**42,240**	.....	.....	.....

UTAH.

Ogden*—				Kalamein Pipe
1910.....	.....	.....	.....	40,000
Progress.	.....	.....	.....	8,000
1911.....	.....	.....	.....	**40,000**

* 5,280 ft. cement pipe proposed for 1911.

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Provo—				Cement
1910.....	47,500	.....	.....	.....
1911.....	.....	.....	**18,000**	**18,000**
Salt Lake City—				Vitrified pipe
1910.....	119,911	.....	.....	193
Progress.	2,000	.....	.....	.....
1911.....	**105,600**	.....	.....	.....

VERMONT.

Barre—				
1910.....	175	960	.....	.....
Bellows Falls—				
1911.....	**1,000**	.....	.....	.....
St. Albans—				
1910.....	3,100	.....	.....	.....

VIRGINIA.

Chatham—				
1910.....	.....	1,000	.....	.....
Danville—				
1910.....	174,500	.....	.....	.....
Fredericksburg—				
1910.....	2,000	.....	.....	.....
Richmond—				
1910.....	51,400	.....	.....	.....
1911.....	**47,600**	.....	.....	.....

WASHINGTON.

Bellingham—				Galvanized
1910.....	7,850	.....	15,837	1,678
Progress.	440	.....	.....	.....
1911.....	**5,000**	.....	**12,000**	.....
Colfax—				
1910.....	.....	9,000	.....	.....
Kent—				
1910.....	.....	.....	52,800	.....
Pt. Angeles—				
1910.....	.....	.....	.....	*52,800

*Wood, steel, cast-iron and wrought iron pipe.

Port Townsend—				
1910.....	.....	18,000	10,000	.....
Seattle*—				Steel
1910.....	208,400	.....	6,980	690

*Data regarding prospective work too late for this table.

Spokane—				
19 10.....	103,800	.....	31,700	*360,800

*Kalamein, 308,000 ft.; riveted steel force mains, 52,800 ft.

Tacoma—				
1910.....	97,947	.....	18,283	.....
Progress.	16,465	.....	54,986	.....
Walla Walla—				Kalamein
1910.....	.....	.....	.....	*15,840
1911.....	.....	.....	.....	**26,400**

*Steel pipe, 6,000 ft.

Wenatchee—				
1910.....	10,560	.....	9,000	.....

WEST VIRGINIA.

Fairmont—				
1910.....	10,560	.....	.....	.....

Middlebourne—Considering installation of water works.

Romney—				
1911.....	**15,800**	.....	**1,200**	.....
Wheeling.				
Progress.	7,400	.....	.....	.....

WISCONSIN.

Berlin—				
Prospect.	.....	2,600	.....	.....
Burlington—				
1910.....	4,032	.....	.....	.....
1911.....	**4,000**	.....	.....	.....
Eau Claire—				
1911.....	**6,500**	.....	.....	.....
Hartford—				
1910.....	1,000	.....	.....	.....

LaCrosse—Extensions in prospect for 1911.

Milwaukee—				Water pipe tunnel
1910.....	87,389	.....	.....	467
1911.....	**82,280**	.....	.....	.....
Port Washington—				
1910.....	100	.....	.....	.....
1911.....	**2,000**	.....	.....	.....

Cities	Cast Iron Pipe	Wrought Iron Pipe	Wooden Pipe	Others
Shawano—				
1911	**17,245**	.....	.....	.....
Sparta—				
1910	900	.....	.....	.....
1911	**5,280**	.....	.....	.....
Watertown—				
1910	1,800	.....	.....	.....
1911	**500**	.....	.....	.....
CANADA.				
Kingston, Ont.—				
1910	3,960	.....	.....	.....
1911	**2,640**	.....	.....	.....
Revelstoke, B. C.—				
1910	.....	.....	28,000	.....
Swift Current, Sask.—				
1910	.....	5,280	.....	.....
1911	.....	**42,240**	.....	.....
Toronto, Ont.—				
1910	154,900	.....	.....	.....
1911	**317,000**	.....	.....	.....
Winnipeg, Man.—				
1910	73,600	.....	.....	.....

WATER SUPPLIES

The following items, arranged alphabetically by States and cities, give the reports of work for 1911 in connection with the water supply department of water works plants.

The information includes that regarding construction of reservoirs, dams, pumping stations, filtration plants, etc. It also includes data regarding tanks, meters and other appurtenances not readily included in the preceding table:

ALABAMA.

Dothan—In 1911 this city will build a 1,000,000-gal. reinforced concrete reservoir and construct a combined electric power and pumping station.

ARKANSAS.

Arkansas City—A 4,000,000-gal. tank was built, 2 boilers and 2 pumps were purchased in 1910.

Batesville—A filtration plant will be built and a 9x12 Gould triplex pump will be purchased in 1911.

CALIFORNIA.

Lodi—A 100,000-gal. steel tank was built in 1910.

Palo Alto—A concrete water tank was constructed in 1910. In 1911 a new building, new well and pump were installed.

Portersville—In 1911 an auxiliary station, including a 500,000-gal. reservoir, will be constructed.

San Bernardino—In 1911 a reservoir will be constructed, which will be the third in the present system.

San Diego—A 17,620,000-gal. reinforced concrete reservoir was completed in 1910.

Santa Cruz—Two small dams were built in 1910.

Visalia—In 1911 an electrically-driven 500,000-gal.-per-minute 4-in. centrifugal pump will be purchased.

COLORADO.

Rocky Ford—In 1911 a pumping station and filtration plant will be constructed.

CONNECTICUT.

Meriden—The Broad Brook addition and extension will be built.

Perryville—The reservoir will be enlarged in 1811.

South Norwalk—A 50,000-gal. electric pumping station was completed in 1910.

Wallingford—A 100,000,000-gal. reservoir will be built in 1911.

FLORIDA.

Jacksonville—A 3,000,000-gal. covered reinforced concrete reservoir is being constructed and a 950-ft. 10-in. well being driven at present time.

Miami—A circular 50-ft. reservoir, 12 ft. deep, was built, and 1 Plattz 2,000,000-gal. and 1 Lawton-Gordon 3,000,000-gal. pump were purchased.

GEORGIA.

Americus—A 100,000-gal. reservoir will be constructed in 1911.

Atlanta—A coagulating basin of 3,000,000-gal. capacity was completed in 1910, and a 250,000,000-gal. reservoir and 10,000,000-gal. filtration plant are being constructed at present time.

Cordelay—One reservoir, with dam, was constructed in 1910.

Cuthbert—An artesian well and 150,000,000-gal. receiving well will be constructed in 1911.

Ft. Valley—A reservoir and air compressor pumping station will be built in 1911.

Wrightsville—In 1910 the following improvements were completed: A 100,000-gal. reinforced concrete reservoir, a 100,000-gal. steel tank and a 1,500,000-gal. pumping station.

IDAHO.

Lewiston—A 3,500,000-gal. centrifugal pump is being installed.

ILLINOIS.

Aurora—Two 250-ft. artesian wells were driven in 1910. In 1911 2 boilers will be purchased and a stack erected.

Canton—Extensive improvements are contemplated for 1911.

Chicago Heights—In 1911 deep-well pumps, electrical equipment, engines and 1,500 meters will be purchased.

Danville—In 1911 an additional pump unit and an extension to the dam will be added.

Downers Grove—A standpipe will be built in 1911.

Elgin—Eighteen hydrants will be purchased in 1911.

Eureka—In 1911 a 270-gal.-per-minute pump will be bought and a 65-ft. 10-in. well will be driven.

Galena—In 1910 a 20x50 circular steel reservoir was built and steam duplicate pumps were installed.

Galesburg—In 1910 2 boilers, 1 6,000,000-gal. pump, directly connected to Lentz engine, were installed.

Joliet—In 1910 a hypo-sterilization plant was installed, and in progress are 2 pumping plants and 2 artesian wells.

Morton—In 1911 a motor-operated 8-in. well will be driven.

Moweaqua—In 1910 a brick pumping station was erected.

Oak Park—In 1911 a booster plant will be installed.

Quincy—In 1910 1 pumping station and a 6,000,000-gal. $40,000 high duty pump were installed.

Waukegan—In 1910 the pumping station was enlarged and a 6,000,000-gal. pump was installed.

Wheaton—A 500,000-gal, producer gas engine was installed in 1910.

INDIANA.

Anderson—One unit of filtration plant was installed in 1910.

Brazil—A compressor room and air compressor are in progress at present.

Butler—In progress are 2 motor-driven 250,000-gal. pumps.

Columbia City—In 1910 3 350-h. p. vertical boilers were installed.

Columbus—In 1910 6 meters were installed. In 1911 100 more will be added. A filtration plant is also in prospect.

Evansville—In 1910 a Holly pumping station was installed, and in progress is a filtration plant, which will be completed in 1912.

Fort Wayne—In 1910 a reservoir and 3 pumping stations were installed.

Indianapolis—In 1911 a dam will be built at Broad Ripple and a large amount of work be done at the pumping station and filtration plant.

Logansport—In 1910 a timber dam and a 9,000,000-gal. pumping station were installed. In 1911 a 6,000,000-gal. pump 273 valves are in prospect for 1911. and a 500,000-gal. centrifugal pump, together with a brick addition to the pumping station, will be added.

Marion—In 1910 4 valves, 10 hydrants and 66 meters were installed. In 1911 3 valves and 3 hydrants will be added.

Martinsville—A supply well was drilled in 1910.

Mishawaka—In 1910 a reservoir and pumping station will be installed.

Newcastle—An auxiliary pumping station will be installed in 1911.

Noblesville—In 1910 3 reservoirs, 1 pumping station and 2 1,500,000-gal. pumps, with 1 air compressor, will be installed.

Remington—A filtration plant will be installed in 1911.

Richmond—Three 150-h. p. horizontal boilers were installed in 1910.

Rushville—In 1911 2 8 and 16-in. wells were driven.

Tipton—A $900 extension was added to the pumping station and 41 meters were installed in 1910. In 1911 extensions to the amount of $3,000 to the pumping station will be completed, and 100 meters will be added.

IOWA.

Clinton—A 2,200-ft. 10-in. well was drilled in 1910.

Council Bluffs—In 1910 1 filtration plant was completed. The city has commenced condemnation proceedings to acquire the plant, which is at present in private ownership.

Des Moines—In 1910 1 pumping station and a 3,300-lin.-ft. 4-ft. circular gallery were constructed.

Eldora—New machinery was installed in 1910.

Ft. Dodge—In 1911 a new deep-well and pump will be put in.

Grinnell—An air compressor was completed in 1910.

Independence—Two triplex pumps were added in 1910.

Indianola—Twenty-one Eddy hydrants were added in 1910.

Mason City—A $3,000 pumping station was completed in 1910. A $6,000 one is in prospect for 1911.

Muscatine—In 1910 30 hydrants were installed. In 1911 30 hydrants and a standpipe will be added.

Sigourney—One filtration plant will be constructed in 1911.

Sioux City—Three 16-in. wells were driven in 1910.

Waterloo—In 1910 a 1,750,000-gal. reservoir was constructed. In 1911 a centrifugal pump for artesian wells and dynamos to drive same will be installed.

Webster City—A pumping station, with a 50-h. p. gasoline engine for emergency use, was completed in 1910.

KANSAS.

Abilene—In progress is a 100-ft. 130,000-gal. standpipe.

Arkansas City—In progress is a complete $90,000 system, and in prospect is 1 dam, 1 pumping station and 1 filtration plant.

Burlington—Wells are in prospect for 1911.

Cherryvale—An electric pumping station was completed in 1910.

Clay Center—A 1,000,000-gal. pump will be added in 1911.

Coffeyville—In prospect for 1911 are 1 dam, 1 boiler and a 6,000,000-gal. filtration plant.

Emporia—An engine in prospect for 1911.

Holton—Two air-lift pumping stations and 2 Roop oil burners for boilers were installed in 1910.

Manhattan—In prospect for 1911 is 1 2-stage, 5-in. vertical, motor-driven turbine pump.

Newton—An addition to the pumping station, a 200,000-cross compound flywheel pumping engine and 2 wells are in prospect for 1911.

Ottawa—At present the intake at the pumping station is being improved.

Pratt—A 100,000-gal. reservoir was completed in 1910.

Topeka—Additional wells will be drilled in 1911.

KENTUCKY.

Earlington—A 150,000-gal. reservoir is in progress.

Louisville—In 1910 a coagulating basin was completed. A 30,000,000-gal. centrifugal pump, an intake tower costing $69,800 and a 30,000,000-gal. turbine-driven centrifugal pump costing $40,000 are being installed.

Newport—A $60,000 reservoir and boilers costing $4,000 were completed in 1910.

Owensboro—A $30,000 softening plant is in prospect for 1911.

LOUISIANA.

Morgan City—A complete water works system is in prospect for 1911.

MAINE.

Augusta—Reservoir extensions, additions to the dam, a new floor and brick arches for the pumping station will be built, and 20,000 white pine trees will be set out on the watershed.

MARYLAND.

Baltimore—A 20,000,000,000-gal. reservoir, a 120,000,000-gal. filtration plant and a dam 100 ft. long. by 70 ft. in height are in prospect.

Brunswick—A concrete reservoir is in progress.

Cumberland—James H. Fuertes is investigating for the proposed $500,000 water supply system, which will be voted on shortly.

Pocomoc City—New wells are proposed to reinforce present supply.

MASSACHUSETTS.

Attleboro—One reservoir and dam are being constructed.

Easthampton—A 2,000,000-gal. concrete covered reservoir was completed in 1910. In 1911 an engine and pump will be purchased.

Greenfield—A storage reservoir is being constructed.

Reading—A 1,500,000-gal. filtration plant was completed in 1910.

MICHIGAN.

Battle Creek—A small extension to the pumping station is in prospect.

Belding—In 1910 72 service lines were completed. For 1911 4 wells are in prospect.

Bessemer—One additional reservoir is in prospect.

Escanaba—A 6,000,000-gal. filtration plant was completed in 1910.

Flint—A $400,000 plant, with pipe extensions, is in prospect for 1911.

Grand Rapids—A pumping station is nearly completed. A contract has been let for a $400,000 filtration plant, with pipe extensions.

Hancock—A 1,000,000-gal. reservoir has been constructed and a 30-pipe 2-in. well point has been sunk. An electric pumping station will be built in 1911.

Harbor Springs—Two reservoirs and a $13,000 pumping station are in prospect.

Kalamazoo—A 350,000-gal. standpipe was constructed in 1910.

Marshall—Extensive improvements to the pumping station are in prospect for 1911.

Mt. Clemens—A 3,000,000-gal. pumping engine is in prospect for 1911.

Norway—A 3,000,000-gal. reservoir was completed and a 9x12 triplex pump of 500,000 gals. capacity was installed. Ten hydrants will be purchased in 1911.

St. Johns—A 1,000,000-gal. pumping engine is in prospect for 1911.

Wyandotte—A 3,000,000-gal. Pratt Iron Works pump was purchased and a $5,000 building constructed in 1910.

MINNESOTA.

Appleton—A 500-gal.-per-minute air lift steam or motor-driven pump will be installed in 1911.

Cloquet—Repairs and extensions to pumping station were completed in 1910, and further extensions are in prospect for 1911.

Duluth—A 5,000,000-gal. reservoir and a pumping station are in prospect for 1911.

Easton—A 50,500-gal. 80-ft. tower is in prospect for 1911.

Faribault—A $750 condenser was completed in 1910. In 1911 deep wells costing $75,000 and repairs to the reservoir amounting to $2,000 will be completed.

Madelia—A tank reservoir is in prospect for 1911.

Mankato—A 60,000-gal. tank and tower are in prospect for 1911.

Montevideo—An electric water pumping station was installed in 1910. A secondary station in prospect for 1911.

Red Wing—A $13,000 reservoir was completed in 1910.

St. Paul—A 200,000-gal. tank, 2 5,000,000-gal. pumps at Centerville station, a deep well pumping plant for 6 12-in. wells at West St. Paul are in prospect for 1911.

St. Peter—A cement-lined reservoir is in prospect for 1911.

Virginia—A 250,000-gal. concrete surface tank was completed in 1910.

Worthington—A 150,000-gal. tank, with a 65-ft. tower, was completed in 1910.

MISSOURI.

Brookfield — A motor-driven duplex pump and a 100-h. p. tubular boiler were installed in 1910.

Glasgow—A pumping station and a filtration plant are in prospect for 1911.

Kansas City—A 45,000-gal. reservoir was completed at Quindaro in 1910. A hypochlorite system filtration plant is in progress at present. A 30,000,000-gal. engine at Quindaro and a high-pressure pump at Turkey Creek are in prospect. 8,800 ft. Missouri revetment work is in prospect for 1911.

Lexington—Additional pumps for the pumping station and reservoir extensions are in prospect for 1911.

Webb City—A 1,500,000-gal. reinforced concrete reservoir is in prospect for 1911.

MONTANA.

Bozeman—The reservoir will be enlarged to four and a half times its present capacity, in 1911.

Deer Lodge—Two reservoirs, and one dam were completed in 1910.

Glasgow—A 500,000-gal. reservoir and one pump were installed in 1910.

Great Falls—Two 2,500,000-gal. reservoirs, one 1,500,000-gal. electric centrifugal pump, two 2,000,000-gal. centrifugal pumps and one 8,000,000-gal. filtration plant are in prospect for 1911.

Helena—A 5,000,000-gal. concrete-lined reservoir, a complete new system (estimated cost, $590,000), 260 hydrants and

NEBRASKA.

Chadron—A $500,000 dam is in prospect for 1911.

Holdredge—Additional pumps for the pumping station and two new wells were installed in 1910.

Norfolk—The pumping station was remodeled in 1910, and a new pump and boiler will be added in 1911.

Red Cloud—A 100,000-gal. reservoir is in prospect for 1911.

Seward—A 300,000-gal. motor-driven water works pump, a triplex pump and a 24-ft by 45-ft. well were completed in 1910.

Tecumseh—A 125,000-gal. tank on tower is in prospect for 1911.

University Place—Electric pumps are in prospect for 1911.

Wymore—A pumping station is in prospect for 1911.

NEW HAMPSHIRE.

Keene—A 476-ft. earth dam, concrete core, was completed in 1910.

Raymond—A new boiler was completed in 1910.

NEW JERSEY.

Atlantic City—A $50,000 pumping station was installed in 1910. A 120-k. w. generator and engine are being installed at present.

Beach Haven—An aeration system filtration plant is in prospect for 1911.

New Brunswick—A boiler for the pumping station is in prospect for 1911.

Perth Amboy—A new stack, 2 200-h. p. boilers, 1 12,000,000-gal. pump and 21 ground storage pumps were installed in 1910.

Plainfield—New wells and an increased pumping capacity are in prospect for 1911.

NEW YORK.

Albany—Repairs to 3 triplex pumps were completed in 1910.

Auburn—A hypochlorite plant for use during the spring freshet is in course of construction.

Batavia—A 600-cu. yd. concrete dam is in prospect for 1911.

Binghamton—A 5,000,000-gal. reservoir is in prospect for 1911.

Buffalo—A 215,000-gal. pumping station is in progress of construction and a new intake pipe is being installed. A 66,000-ft. 9x12-ft. tunnel is in prospect for 1911.

Corning—Two reservoirs and 1 pumping station were completed in 1910.

Dunkirk—A new boiler house was completed in 1910.

Elmira—A 5,000,000-gal. reservoir is in prospect for 1911.

Frankfort—A 20,000,000-gal. reservoir is in prospect for 1911.

Geneseo—A cement-lined reservoir and a filtration plant are in prospect for 1911.

Huntington—A 25,000-gal. tank and 1 air tank are in prospect for 1911.

Jamestown—A 10,000,000-gal. reservoir is in prospect for 1911.

Keeseville—A concrete reservoir, 60x 60x15, all-rock work, is in prospect for 1911.

Kingston—The project for raising Cooper Lake dam 10 ft. higher is in prospect for 1911.

Little Falls—A mechanical filtration plant is in prospect for 1911.

Millerton—A retaining wall and a filtration plant are in prospect for 1911.

Niagara Falls—A $75,000 intake crib and pipe line and a $15,835 conduit were constructed in 1910. A $124,880 pumping station and a $234,565 filtration plant are in progress of construction.

Norwich—A 2,000,000-gal. triple pump and a 75-h. p. gasoline engine for emergency use are in progress of installation.

Ogdensburg—One dam and 1 filtration plant are in prospect.

Plattsburg—A 170,000,000-gal. reservoir was constructed in 1910. Two 6,000,000-gal, reservoirs are in prospect for 1911.

Rome—A 15,000,000-gal, reservoir, a dam and 5,280 ft. of tunnel were completed in 1910.

Seneca Falls—In 1910 2 125-h. p. boilers were installed.

Troy—A 600,000,000-gal. reservoir is in prospect for 1911.

Watertown—Two concrete reservoirs were completed in 1910.

White Plains—A new standpipe was constructed in 1910.

NORTH CAROLINA.

Greensboro—In 1911 a 2,000,000-gal. pump, with steam turbine, 2 125-h. p. boilers and a stack, will be installed. An extension will be added to the filtration plant to filter 2,000,000 gallons per day.

Wilmington—A 1,000,000-gal. reservoir, a 4,000,000-gal. pump, 4,500,000-gal. filter units, a steel tower and new sedimentation basin were completed in 1910.

NORTH DAKOTA.

Grand Forks—A 4,000,000-gallon rapid sand filter was completed in 1910.

Mandan—Three reservoirs, a pumping station and a filtration plant are in prospect for 1911.

Minot—A 100,000-gal. tank, 2 Lawrence low-duty pumps, 2 Fairbanks-Morse horizontal duplex engines and a $44,400 lime and iron system filtration plant were completed in 1910.

Wahpeton—A 400,000-gal. concrete reservoir was completed in 1910.

Williston—A round concrete reservoir, 72 ft. diameter, 14 ft. depth, was completed in 1910. A 500,000-gal. filtration plant and 150-h. p. boilers will be installed in 1911.

OHIO.

Akron—F. A. Barbour is preparing plans for a $2,500,000 to a $3,000,000 system.

Alliance—A storage dam is in prospect for 1911.

Bellefontaine—A 100-h. p. boiler is in prospect for 1911.

Bucyrus—A 3,000,000-gal. pump and 2 125-h. p. boilers or gas engines will be installed in 1911.

Cadiz—Three wells and an air lift were completed in 1910.

Canal Dover—Four mains, 802 ft., and 4 wells were completed in 1910.

Cleveland—Two 25,000,000-gal. pumping engines are being installed. A lake tunnel, high-pressure fire-service pumping station is in prospect for 1911.

Coshocton—Eleven 10-in. filtration wells are in progress of construction. One 3,000,000-gal. pump, 1 4,000,000 pump, 2 1,500,000-gal. centrifugal motor-driven pumps and 1 vertical cross compound 125,000,000-gal. duty pump are in prospect for 1911.

East Liverpool—One pumping station and a well system are in prospect for 1911.

Leetonia—More wells are in prospect for 1911.

Millersburg—A 26-ft. well is in prospect for 1911.

Niles—A 3,000,000-gal. filtration plant is in prospect for 1911.

Norwood—A filtration plant has been proposed.

Port Clinton—A $24,000 mechanical filtration plant is in prospect for 1911.

Toledo—A 60,000,000-gal. clear-water basin, a 15,000,000-gal. centrifugal pump, direct connected; 14 1,000,000-gal, filters and high-pressure mains in business district are in prospect for 1911.

West Carrollton—One reservoir, 1 dam and 1 8-in. well are in prospect for 1911.

Zanesville—Two reservoirs, with a capacity of 4,500,000 gallons, 2 pumping stations and a 367,000-gal. standpipe were completed in 1910.

OKLAHOMA.

Clinton—A filtration plant was installed in 1910.

El Reno—Three reservoirs, 1 dam, 1 pumping station and 1 filtration plant are in prospect for 1911.

Guthrie—A $5,000 filtration plant was completed in 1910.

Lawton—Two reservoirs and a pumping station were completed in 1910. A 1,083-acre reservoir and 1 50-ft. dam are in progress of construction.

Muskogee—A $40,000 reservoir, a $75,000 pumping station and a $175,000 filtration plant are in prospect for 1911.

Oklahoma City—The pumping station was enlarged to double capacity in 1910, and 1 10,000,000-gal. cross compound Corliss engine, 250-k. w. direct-connected generator were purchased in 1910. A 200,000-gal. equalizing tower and 2,000 meters are in prospect for 1910.

Tulsa—A $15,000 reservoir and a $15,000 dam are in prospect for 1911.

OREGON.

The Dalles—The work of relining the reservoir with concrete is in prospect.

PENNSYLVANIA.

Bellwood—One reservoir is in prospect for 1911.

Bradford—The work of enlarging the reservoir from 37,000,000 to 200,000,000 gals. is in progress.

Chambersburg—A 2,500,000-gal. intermediate reservoir and a dam at the intake are in progress of construction.

Dalton—A 2,000-gals.-per-day pumping station was completed in 1910.

Doyleston—A 650-ft. well was installed in 1910.

Erie—A sterilization plant is in process of construction.

Franklin—A boiler and pump are in prospect for 1911.

Harrisburg—One reservoir and 1 dam are in progress.

Ligonier—A circular concrete reservoir, 85 ft. in diameter, is in prospect for 1911.

Northeast—A 4,000,000-gal. brick reservoir, 80,000,000-gal. reservoir and a filtration plant were completed in 1910.

Port Allegheny—An $8,000 pumping station was completed in 1910. The reservoir will be enlarged and used for storage in 1911.

Punxsutawny—A 65,000,000-gal. reservoir, a pumping station and a 3,000,000-gal. filtration plant were installed in 1910.

Somerset—A 500,000-gal. reservoir and 1 pumping station are in prospect for 1911.

RHODE ISLAND.

Rumford—Additions to the pumping station were completed in 1910.

SOUTH CAROLINA.

Chester—A $3,000 sedimentation plant, a $3,000 complete pumping station, a $4,000 filtration plant and 3 electric-driven,electric-valve turbine pumps were completed in 1910.

Florence—An air compressor and receiver and a 1,500-ft. deep well completed in 1910.

Rock Hill—The work of rebuilding the system at a cost of $50,000 is in prospect for 1911.

SOUTH DAKOTA.

Falkton—A $1,500 reservoir and a $10,000 pumping station were completed in 1910.

Minot—A 100,000 gallon reservoir was completed in 1910.

Pierre—A $5,000 concrete reservoir and a new $25,000 pump were completed in 1910. A $5,000 addition to the pumping station is in prospect for 1911.

TENNESSEE.

Columbia—A 1,000,000-gallon reservoir and a 2,000,000-gal. pumping station were completed in 1910.

Knoxville—A settling basin was completed in 1910. A 12,000,000 gallon filtration plant is in prospect for 1911.

TEXAS.

Belton—A reinforced concrete standpipe, 250,000 gals., 75 ft. high, is in progress.

Dallas—A 7,000,000,000-gal. reservoir is in process of construction.

Denison—A 1,500,000,000-gal. reservoir, with dam, was completed in 1910. A 2,000,000-gal. pumping station and 4 new wells are in progress.

El Paso—Twenty-two hydrants are in process of installation. Ten wells are in prospect for 1911.

Greenville—A 250,000-gal. artesian well was drilled in 1910. A 450,000-gal. reservoir is in prospect for 1911.

San Antonio—A new boiler was completed in 1910.

San Marcos—Seven fire hydrants were installed ni 1910. Ten more will be added in 1911.

Texas City—One reservoir and 1 dam are in prospect for 1911.

UTAH.

Ogden—A 15,000,000-gal., $50,000 concrete reservoir was installed in 1910. A filtration plant is in prospect for 1911.

VERMONT.

Barre—A 45,000,000-gal. reservoir and a dam were completed in 1910. Sewer work amounting to $50,000 is in progress.

St. Albans—A 10,000 rip-rap reservoir was completed in 1911.

WASHINGTON.

Kent—A 500,000-gal. reservoir was completed in 1910.

Port Angeles—A dam was completed in 1910.

Port Townsend—One 4,000,000-gal. and 1 2,000,000-gal. reservoir were completed in 1910.

Spokane—One 37,500,000-gal. pumping station and 1 standpipe were completed in 1910. One 12,500,000-gal, pumping station and 2 standpipes are in process of construction.

Wenatchee—A 7,054,900-gal. reservoir and 1 pumping station were completed in 1910.

WEST VIRGINIA.

Fairmont—A pumping station is in prospect for 1911.

Romney—A 150,000-gal. reservoir and a pumping station are in prospect for 1911.

Wheeling—An intake well and building and 2 20,000-gal. tanks were completed in 1910. Two motor-driven pumps are being installed.

WISCONSIN.

Antigo—New pumps are in prospect for 1911.

Burlington—A concrete retaining wall around a standpipe is in prospect for 1911.

La Crosse—A 6,000,000-gal. pumping station and a filtration plant are in prospect for 1911.

Milwaukee—Three boilers were completed in 1910. One 12,000,000-gal. pumping engine is being installed.

Sharon—A 110-h. p. internally-fired Scotch water-back boiler is in process of installation. The power house is being enlarged.

Sparta—A high-pressure boiler is being installed. The remodelling of the pumping station and the installation of a 1,500,000-gal. Corliss pumping engine are in prospect for 1911.

Watertown—One artesian well, 1,000 feet deep, was sunk in 1910.

Waupaca—A 187-ft. 12-in. intake main to Mirror Lake was completed in 1910.

Waupun—A pumping station was completed in 1910.

CANADA.

Winnipeg—One pumping station was installed in 1910.

Toronto, Ont.—A 33,000,000-gal. reservoir and 2 10,000,000-gal. engines were added in 1910. A filtration plant is in process of construction.

ELECTRIC LIGHT IMPROVEMENTS

The following table gives a summary of the reports of additions to electric lighting plants made in 1910 and to be made in 1911. The first column gives the number of feet of street wiring done or proposed, the second the number of poles, the third the number of feet of underground conduits and the fourth the number of street lamps.

As nearly as may be, the kind of street lamps is explained in a note under each town installing them. The number of kinds of lamps is now so great that this information is in general only as to class of lamp, and not always so definite as that.

The data for 1911 are printed in heavy-faced type, that they may be distinguished readily:

CALIFORNIA.

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
Alhambra—				
1910.....	248,000	.....	.....	642
Antioch—				
Municipal electric plant proposed.				
Lodi—				
1910.....	105,600	300	.....	.....
1911.....	.....	.....	**2,500**	***20**
*Ornamental boulevard lights.				
Palo Alto—				
1910.....	2,600 ..	20	.....	***542**
*Tungsten lights.				
Pasadena—				
1910.....	95,000	400	.....	470
Santa Clara—				
1911..... Minor extensions.				
Santa Cruz—				
1910.....	.....	.....	5,000	***660**
*Incandescent lights.				
Progress.		100	.....	.....
1911.....	.....	.....	.....	***100**
*Arc lights.				
S. Pasadena—				
1910.....	185,000	100	5,280	500
1911.....	.....	.....	**5,280**	.....

COLORADO.

Holyoke—				
1910.....	26,400	.....	.....	.....
1911.....	**5,280**	.....	.....	.....

CONNECTICUT.

New Britain—				
1910.....	.....	.....	23,324	.....
1911.....	.....	.....	Extensions.	

DISTRICT OF COLUMBIA.

Washington—
$125,000 for electric arc lighting now in progress. $395,000 for 1911.

FLORIDA.

Jacksonville—				
1910.....	.....	.....	.....	***236**
*Tungsten lights.				
1911.....	**450,000**	.....	.....	.....
Miami—				
1910.....	110,880	872	.....	***285**
*Mazda lights.				

GEORGIA.

Cordele—				
1910.....	.....	450	.....	50
Cuthbert—				
1911—150 k. w. generator, 300-h. p. engine, 2 150-h. p. boilers.				

ILLINOIS.

Chicago—				
1910.....	79,200	.....	.....	.....
1911—Prospective work not known until April 1st.				
Chicago Heights—				
1910.....	.....	.....	.....	***2,640**
*Ornamental boulevard lights.				
Collinsville—				
1910.....	158,000	1,200	.....	***400**
*50 Arc lights; 350 Tungsten lights.				
Decatur—				
Progress—New plant.				
Downers Grove—				
1910.....	.....	.....	.....	122
Freeport—				
1911—City will let 5-year electric lighting contract before April 1.				
Galena—				
1910.....	249,235	2,900	.....	92
Galesburg—				
1910.....	26,400	50	.....	15
1911.....	**26,400**	**75**	**26,400**	**25**
Macomb—				
1910.....	.....	200	.....	.....
1911.....	**5,280**	**100**	.....	.....
Metropolis—				
1910.....	47,520	10	.....	3
Morton—				
1910.....	30,000	275	.....	52
Oak Park—				
1910.....	.....	.....	.....	41
1911.....	.....	.....	.....	**25**
Paris—				
1910.....	2,000	8	.....	10
1911.....	**158,000**	.....	.....	.....
Pekin—				
1910.....	36,100	.....	108	178
Taylorville —				
1910.....	63,400	.....	.....	***200**
1911.....	**10,560**	.....	.....	.....
*40Arc lights; 160 incandescent lights.				

INDIANA.

Butler—				
Progress—Complete electric lighting system with 2 gas producer engines, 2 generators.				
Columbia City—				
1910.....	5,280	125	.....	.....
1911.....	.....	.....	.....	**75**
Converse—				
1910.....	.....	3	.....	60
Crawfordsville—				
1910.....	26,400	.....	.....	.....
Progress—$125,000 plant.				
Evansville—				
1910.....	.....	.....	.....	***549**
*509Arc lights; 40 incandescent lights.				
Ft. Wayne—				
1910.....	300,230	392	.....	***84**
1911.....	**400,000**	**500**	.....	**50**
*62 Arc lights; 22 Tungsten lights.				
Indianapolis—				
1910.....	.....	.....	.....	203
Logansport—				
1910.....	26,400	180	.....	.....
1911.....	**10,560**	**80**	.....	**50**
Martinsville—				
1910.....	.....	.....	.....	***40**
*Tungsten lights.				
1911—New unit.				
Remington—				
1910—One private plant.				
Rochester—				
1910.....	.....	.....	.....	83
Rushville—				
1910.....	10,560	.....	.....	.....
1911.....	**15,840**	.....	.....	***66**
*Ornamental boulevard lights.				

IOWA.

Ames—				
1910.....	10,560	100	.....	20
Cedar Rapids—				
1910.....	.....	.....	.....	***40**
*Tungsten lights.				
Eldora—				
1911.....	.....	.....	.....	**50**
Independence—				
1911.....	.....	.....	.....	**16**
300 k. w. generator and engine to be installed in 1911.				
Indianola—				
1910—125-h. p. engine and generator installed. Old lights replaced by electroliers.				
Pella—				
1910—$30,000 municipal plant.				
Webster City—				
1911—Entire new station, $15,000 fireproof building.				

KANSAS.

Argentine—				
1910.....	.....	.....	.....	50
Private plant.				
Clay Center—				
1910.....	.....	.....	.....	30
Coffeyville—				
1910.....	10,000	25	.....	5
1911.....	**50,000.**	**150**	**300**	**10**
Low pressure turbine installed in 1910.				
Garden City—				
1910.....	52,800	300	.....	.....
Holton—				
1910.....	50,000	.....	.....	10
McPherson—				
1911—Electric street lighting to be installed in business section.				

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
Ottawa—				
1910.....	5,280	50	.....	*10
Progress.	10,560	.....	.....	.....
*Tungsten lights.				
KENTUCKY.				
Ashland—				
1910.....	.....	.....	.....	129
Earlington—				
Progress.	.....	2,500	.....	.....
LOUISIANA.				
Morgan City—				
1910.....	.....	.....	.....	40
MAINE.				
Westbrook—				
1910.....	10,000	100	.....	.....
MASSACHUSETTS.				
Fall River—				
1910.....1,135,416		3,724	77,421	844
Lowell—				
1910.....	.....	.....	.....	*14
*2Arc lights; 12 incandescent lights.				
Quincy—				
1910.....	.....	.....	.....	67
Wakefield—				
1910.....	16,739	90	.....	*13
*Incandescent lights.				
Worcester—				
1910.....	.....	.....	500,000	.....
MICHIGAN.				
Alpena—				
1910.....	.....	60	.....	15
Bessemer—				
1910.....	5,000	.....	.....	20
Grand Rapids—				
1910.....	21,120	91	.....	36
Lake City—				
1910.....	400	6	.....	.....
Marshall—				
1910—187 k. w. alternator, and 264-h. p. water wheel.				
Norway—				
1911—System to be extended 2½ miles.				
St. Johns—				
1910—2 3-phase, 2,300 v. generators, 350 k. v. a. changed from single to 3-phase.				
Whitehall—				
1910.....	33,000	.....	.....	60
1911.....	**250**	.....	.....	**25**
MINNESOTA.				
Faribault—				
1910.....	.....	.....	.....	110
New Ulm—				
1910.....	3,960	.....	5,200	*44
*Ornamental boulevard lights.				
St. Cloud—				
1910.....	10,560	70	.....	.....
St. Peter—				
1910.....	15,800	.....	.....	10
1911.....	.....	**200**	.....	.....
Will change from open arcs to tungstens in 1911.				
Virginia—				
1910.....	26,400	.....	.....	20
MISSISSIPPI.				
Yazoo City—				
1910.....	10,560	25	.....	9
MISSOURI.				
Fulton—				
1910.....	6,056	53	.....	.....
Independence—				
1910—$20,000 overhauling and betterment of electric light plant in 1910.				
Lebanon—				
1910.....	100,000	400	.....	500
Oregon—				
1911—New equipment.				
Tarkio—				
1910.....	.....	.....	.....	*115
*Tungsten lights.				
System changed to tungsten in 1910.				
MONTANA.				
Deer Lodge—				
1910.....	26,400	.....	.....	25
Glasgow—				
1910.....	10,500	100	.....	10
Great Falls—				
1910.....	.....	.....	.....	*40
1911.....	.....	.....	.....	**56**
*Ornamental boulevard lights.				
NEBRASKA.				
Hastings—				
1910.....	15,800	.....	.....	.....
Holdredge—				
1910.....	52,800	350	.....	*109
*Tungsten lights.				
Norfolk—				
1910—New boilers.				
1911.....	.....	.....	**5,000**	.....
Conduits to be built throughout city.				
Red Cloud—				
1910.....	5,280	.....	.....	.....
1911.....	**26,400**	.....	.....	.....
University Place—				
1911.....	**3,500**	.....	.....	**20**
Wymore—				
1911.....	**26,400**	.....	.....	.....
NEVADA.				
Reno—				
1910—One generator.				
1911—One generator; new plant of 3,000 h. p. water power.				
NEW JERSEY.				
Bayonne—				
1910.....	.....	.....	.....	24
Garfield—				
1911—One elctric plant.				
Irvington—				
1911—One municipal plant.				
Jersey City—				
1910.....	.....	.....	.....	22
17 gas street lamps.				
Nutley—				
1910.....	.....	.....	.....	20
Rutherford—				
1911—New franchise contract to be entered into in 1911 for electric lights.				
NEW YORK.				
Plattsburg—				
1910.....	10,000	.....	.....	.....
1911.....	.....	.....	.....	***14**
Salamanca—				
1910.....	12,300	40	.....	18
1911.....	**15,800**	**50**	.....	**25**
*5 Arc lights; 9 incandescent lights.				
Solvay—				
1910.....	5,000	.....	.....	85
1911	**5,000**	.....	.....	**40**
Troy—				
1910.....	.....	.....	.....	714
Utica—				
1910.....	.....	.....	.....	936
1911.....	.....	.....	.....	**20**
NORTH CAROLINA.				
Greensboro—				
Electric lighting let by contract.				
Greenville—				
1910.....	400	100	.....	10
1911.....	**1,000**	**300**	.....	**10**
Raleigh—				
1910.....	3,000	.....	.....	50
NORTH DAKOTA.				
Grand Forks—				
1910—A $16,000 street lighting plant installed in 1910.				
Minot—				
Duplication of electric plant proposed for 1911.				
Williston—				
1910.....	7,640	.....	.....	10
1911.....	**7,000**	.....	.....	***28**
*Ornamental boulevard lights.				
OHIO.				
Cadiz—				
1910.....	.....	.....	.....	60
Canal Dover—				
Progress—300-h. p. gas engine, 200 k. v. a. generators. Several miles copper, secondary.				

Cities.	Wire, Feet.	Poles, No.	Cond'ts, Feet.	Lamps, No.
Carrolton—				
1910.....	.....	150	.....	.....
Progress.	15,800	.....	.....	.....
Cleveland Heights—				
1910.....	.....	.....	.....	12
1911.....	.....	.....	.....	**80**
Euclid—				
1911.....	.....	.....	.....	**10**
Ironton—				
1911.....	.....	.....	.....	**15**
Leetonia—				
Progress.	.....	.....	.....	*90
*Tungsten lights.				
Lorain—				
1910.....	.....	.....	.....	231
1911.....	.....	.....	.....	**350**
Madisonville—				
1911—100 k. w. direct connected unit.				
Napoleon—				
1910.....	37,000	37	.....	.....
Reading—				
1910.....	.....	.....	.....	5
Toledo—				
1910.....	.....	.....	.....	297
1911.....	.....	.....	.....	**200**
Warren—				
Progress—Installing 3 light Mazda tungsten series street lights.				

OKLAHOMA.

Bartlesville—				
1910.....	.....	.....	.....	101
Clinton—				
1911.....	**52,800**	**350**	.....	**40**
Guthrie—				
1910.....	.....	50	.....	.....
Shawnee—				
1910.....	26,400	.....	.....	.....
1911.....	**26,400**	.....	.....	.....

OREGON.

Cloquille—				
1910.....	.....	.....	.....	90

PENNSYLVANIA.

Bloomsburg—				
1911—Will add a few street lamps.				
Chambersburg—				
1910.....	132,000	50	.....	30
Northeast—				
1910.....	105,600	1,000	.....	*110
*39Arc lights; 71 incandescent lights.				
Pittsburg—				
1910.....	.....	.....	.....	6,147
1911.....	.....	.....	.....	**150**
Waynesboro—				
1910.....	.....	.....	800	.....
Williamsport—				
1910.....	.....	.....	.....	68

SOUTH CAROLINA.

Greenville—				
1910.....	.....	.....	.....	180
1911.....	.....	.....	.....	**125**
Union—				
1910.....	47,500	.....	.....	.....
Progress.	15,800	.....	.....	.....
1911.....	**15,800**	.....	.....	.....

SOUTH DAKOTA.

Deadwood—				
1910.....	.....	.....	.....	*200
*Tungstens replacing gas lights.				
Pierre—				
1910.....	11,800	80	.....	20
A $16,000 engine installed in 1910.				
Rapid City—				
1910.....	26,400	2,000	.....	300

TENNESSEE.

Columbia—				
1910.....	7,940	50	.....	*20
*Tungsten lights.				
Paris—				
1910.....	15,800	300	.....	150
1911.....	.....	.....	.....	**10**
Ripley—				
1910—One $14,000 plant installed.				

TEXAS.

Denison—				
1910—250 k. w., 60 cycle a. c. generator installed in 1910 .				
Laredo—				
1910.....	7,900	500	.....	.....
San Marcos—				
1911.....	**26,400**	**300**	.....	**30**
Texas City—				
Progress.	15,800	.....	.....	.....
1911.....	**37,000**	.....	.....	.....

UTAH.

Ogden—				
1910.....	.....	.....	1,600	*60
1911.....	.....	.....	**2,500**	.....
*Tungsten lights.				

VIRGINIA.

Danville—				
1910.....	.....	.....	.....	206

WASHINGTON.

Port Angeles—				
1910.....	79,400	1,000	.....	.....
Seattle—				
1910.....	.....	.....	.....	*59,500
1911.....	.....	.....	.....	*49,900
*Feet of street lighted with ornamental boulevard lights.				
Walla-Walla—				
1910.....	634,000	3,433	2,000	*186
Progress.	38,700	6,750	.....	.....
1911.....	**450,000**	**280**	.....	**20**

WISCONSIN.

Antigo—				
1910.....	31,600	.....	.....	6
1911.....	**10,560**	.....	.....	.....
Burlington—				
1910.....	10,560	50	.....	8
1911.....	**10,560**	**60**	.....	**10**
Milwaukee—				
1910.....	.....	.....	.....	2,198
Oconto—				
1911—Thorough overhauling of electric light system in 1911.				
Port Washington—				
1910.....	10,000	30	.....	20
Ripon—				
1910.....	20,000	.....	.....	.....
Sharon—				
Municipal electric light system proposed for 1911.				
Wausau—				
1910.....	137,000	850	1,900	*410
*160 arc lights; 250 incandescent lights.				

CANADA.

Kingston, Ont.—				
1910.....	4,000	50	.....	.....
1911.....	.....	.....	.....	**50**
Toronto, Ont.—				
1910.....	528,000	5,000	500,000	1,835
1911—Complete hydro-electric plant proposed for 1911.				
Winnipeg, Man.—				
1910.....	52,800	.....	12,300	119
1911.....	.....	.....	.....	**150**

GAS LIGHTING IMPROVEMENTS

The following table gives information as to the number of feet of gas pipe laid in 1910, now under contract and to be laid in 1911. It also shows the number of lamps installed last year and to be installed this year, and gives some idea of improvements recently made to gas manufacturing plants and to be made shortly.

The figures for 1911 are printed in heavy-faced type, that they may be distinguished readily:

ALABAMA.

Cities	Gas Pipe	Gas Plant	Gas Street Lamps
Talladega—			
1910	4,000	.....	.....

CALIFORNIA.

Santa Clara—			
1910	5,280	.....	.....
1911—Minor extensions.			

ILLINOIS.

Decatur—			
1910	42,300	.....	.....
Downers Grove—			
1910	52,800	.....	.....
Galena—			
1910	26,400	One	.....
Macomb—			
1910	2,640	.....	.....
Pekin—			
1910	7,920	.....	.....
1911	**1,500**	.....	.....
Taylorville—			
1910—Complete system.			

INDIANA.

Evansville—			
1910	.....	.....	697
Indianapolis—			
1910	.....	.....	33

IOWA.

Ames—			
1910	63,400	One	.....

KANSAS.

Argentine—			
1910	63,360	Natural	.....
Chanute—			
1910	27,000	.....	.....

KENTUCKY.

Maysville—			
1910	5,280	.....	.....
1911	**2,640**	.....	.....

MASSACHUSETTS.

Lowell—			
1910	15,800	.....	74
Wakefield—			
1910	5,462	.....	.....

MICHIGAN.

Wyandotte—			
1910—Minor improvements.			

MINNESOTA.

Amboy—			
1910	21,100	One	18
Crookston—			
1910	10,000	.....	.....
1911	**15,000**	.....	.....
Duluth—			
1910	46,382	.....	.....
1911	**57,753**	.....	.....
New Ulm—			
1911	.....	One	.....
St. Cloud—			
1910	1,000	.....	.....

MONTANA.

Bozeman—			
1910	26,400	One	.....

NEBRASKA.

Hastings—			
1910	5,280	.....	.....
1911	**4,240**	.....	.....
Norfolk—			
1910	1,200	Entirely renewed	.....
1911	**2,000**	.....	.....

NEW JERSEY.

Beach Haven—			
1910	.....	Acetylene	.....
Millville—			
1910	105,600	.....	.....
Ocean City—			
1910	10,560	.....	.....
1911	**5,280**	.....	.....

NEW YORK.

Cities	Gas Pipe	Gas Plant	Gas Street Lamps
Troy—			
1910	.....	.....	186

NORTH CAROLINA.

Raleigh—			
1910	.....	Double capacity	.....

NORTH DAKOTA.

Grand Forks—			
1910	26,400	.....	.....

OHIO.

Bellefontaine—			
1910	6,600	.....	.....
1911	**3,300**	.....	.....
Carrolton—			
1910	31,700	.....	.....
Galion—			
1910	.....	2 boilers	.....
Zanesville—			
1910	.....	Natural	.....

OKLAHOMA.

Bartlesville—			
1910	.....	.....	130
Shawnee—			
1910	52,800	.....	.....
1911	**52,800**	.....	.....

PENNSYLVANIA.

Chambersburg—			
1910	4,000	.....	.....
McKeesport—			
1910	2,000	.....	.....
Northumberland—			
1910	23,700	High pressure	.....
Pittsburg—		Gasoline	lamps
1910	.....	.....	3,791
1911	.....	.....	**200**
Waynesboro—			
1910	8,920	One	.....
Williamsport—			
1910	.....	Private	.....

SOUTH DAKOTA.

Flandreau—			
1910	500	.....	.....
Pierre—			
1910	2,640	.....	.....

TEXAS.

Denison—			
1910	10,000	.....	.....

VIRGINIA.

Chatham—			
1911	.....	One	.....
Danville—			
1910	95,000	.....	.....
Fredericksburg—			
1911	**400**	.....	.....

WASHINGTON.

Walla-Walla—			
1910	191,600	.....	.....
Progress	23,575	.....	.....

WISCONSIN.

Burlington—			
1910	18,500	.....	.....
1911	**5,280**	.....	.....
Milwaukee—			
1910	.....	.....	2,942
Ripon—			
1910	1,305	.....	.....
Stevens Point—			
1910	.....	One	.....

CANADA.

Kingston, Ont.—			
1910	7,712	.....	.....
Toronto, Ont.—			
1910	.....	.....	1,089

GARBAGE COLLECTION AND DISPOSAL

In the following table are the reports from municipal garbage collection and disposal plants. A few cities report contracts, but many cities operating under the contract system have made no report.

The first column shows the number of wagons and carts purchased last year or to be purchased in 1911. The second column gives the same information as to horses and mules, the third column as to cans for deposit and collection, and the fourth as to completed or prospective garbage disposal plants.

The figures for 1911 are printed in heavy-faced type, that they may be distinguished readily:

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
ALABAMA.				
Dothan—				
1910..	2	2	.....	
Jasper—				
1910..	3	5	30	
CALIFORNIA.				
Coalinga—				
1911..	...	...	.....	5-ton incinerator.
Fresno—				
1910..	15	...	.....	Open burning pit.
Maysville—				
1910..	3	6	Air-tight	Dump.
Oakland—				
1910..	...	...	.....	Garbage shipped to sea, 500 tons per day.
Palo Alto—				
1911..	...	...	.....	Garbage destructor.
Portersville—				
1910..	1	2	200	Dump.
1911..	**1**	**2**	**400**	
San Bernardino—				
1910..	...	...	.....	Under contract.
Santa Clara—				
1910..	...	...	.....	Designed by Cy. Engr. C. E. Moore.
Santa Cruz—				
1910..	...	...	.....	Contract let, 50c per dwelling.
CONNECTICUT.				
Ansonia—				
1910..	1	2	.....	Contracted and fed to swine.
Meriden—				
1910..	...	...	.....	Collected under contract.
New Haven—				
1910..	...	...	.....	By contract.
Torrington—				
1910..	...	...	.....	Collected by farmers.
GEORGIA.				
Americus—				
1911..	**2**	...	**250**	
Atlanta—				
1910..	143	272	.....	Decarie incinerator.
1911..	...	...	.....	2 proposed.
ILLINOIS.				
Chicago Heights—				
1911..	...	...	.....	Decarie incinerator.
Collinsville—				
1910..	1*	4	.....	
Danville—				
1911..	...	...	.....	Incinerator plant.
Dekalb—				
1910..	1	...	.....	
1911..	...	...	.....	One.
Downers Grove—				
1910..	1	2	.....	
E. St. Louis—				
1910..	...	...	.....	Handled by Supt. of streets.
Lake Forest—				
1911..	...	...	.....	One.
Oak Park—				
1910..	3	5	.....	Lewis & Kitchen incinerator, capacity, 15 tons per day, cost, $1.75 per ton.
1911..	**1**	**2**	.....	
Ottawa—				
1910..	2	4	.....	
Paxton—				
1910..	1	2	.....	Dump.
Taylorville—				
1910..	2	4	20	
INDIANA.				
Converse—				
1910..	...	...	.....	Dump.
Evansville—				
1910..	6	14	.....	Eagle crematory.
Hammond—				
1910..	12	8	.....	Dump.
Logansport—				
1910..	3	6	.....	
1911..	...	...	.....	One.
Mishawaka—				
1911..	...	...	.....	One.
Muncie—				
1910..	8	8	.....	Decarie incinerator.
Richmond—				
1910..	5	10	.....	Crematory.
Terre Haute—				
1910..	...	...	.....	Lewis & Kitchen incinerator.
IOWA.				
Burlington—				
1910..	3	6	.....	Burial and incineration.
Creston—				
1910..	...	...	.....	Fed to swine.
KANSAS.				
Garden City—				
1910..	...	...	.....	Dump.
Hutchinson—				
1911..	...	...	.....	Incinerator.
Manhattan—				
1910..	2	4	.....	Contract.
KENTUCKY.				
Louisville—				
1910..	54	108	.....	Incinerator not in use.
Pineville—				
1910..	1	2	12	
LOUISIANA.				
Morgan City—				
1910..	2	4	24	
MAINE.				
Lewiston—				
1910..	4	4	.....	
MASSACHUSETTS.				
Everett—				
1910..	...	...	.....	Under contract.

* Tank flushing wagon.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Lowell—				
1910..	7	7	.....	Decarie incinerator.
New Bedford—				
1910..	...	...	.....	Extraction by steam; 7,132 tons collected; 582 animals in 1910.
Quincy—				
1910..	1	...	.....	
MICHIGAN.				
Grand Rapids—				
1910..	...	...	.....	Collected and delivered on on cars, hauled outside city, fed to swine.
Hancock—				
1910..	...	...	1,000	
Highland Park—				
1910..	1	2	.....	
MINNESOTA.				
Virginia—				
1910..	...	...	500	
MISSOURI.				
Sedalia—				
1911..	...	...	.....	One.
Webb City—				
1910..	1	2	.....	Dump.
MONTANA.				
Billings—				
1910..	3	6	.....	Incinerator.
Butte—				
1910..	...	...	.....	Small incinerator. Most of the refuse is put in trenches or on city dump. Incinerator in prospect to handle all refuse.
Great Falls—				
1910..	...	...	.....	Filling lowlands and river front. Collection by contract.
NEBRASKA.				
S. Omaha—				
1910..	...	...	.....	Collection by contract.
NEW JERSEY.				
Bayonne—				
1910..	4	...	24	
1911	**4**	...	**24**	
Beach Harbor—				
1911..	...	...	.....	Contemplated.
Elizabeth—				
1910..	...	...	.....	Contract.
Garfield—				
1910..	1	2	.....	
Irvington—				
1910..	4	7	.....	
NEW MEXICO.				
Silver City—				
1910..	1	2	.....	
NEW YORK.				
Batavia—				
1911..	...	...	.....	One.
Buffalo—				
1910..	...	...	.....	1 Morse-Boulger 1 Heenan-Froude. Collection by contract.
Elmira—				
1910..	2	4	2,000	Bennett incinerator.
Herkimer—				
1910..	1	2	.....	
Kingston—				
1910..	...	...	.....	Contract.
Middletown—				
1910..	...	...	.....	Contract.
1911..	...	...	**500**	
Troy—				
1910..	26	...	450	
Utica—				
1910..	...	...	.....	Contract.
White Plains—				
1910..	4	8	.....	
NORTH CAROLINA.				
Asheville—				
1910..	...	...	.....	500 wagon loads in 1910.
Greenville—				
1910..	3	6	.....	
1911..	**3**	**2**	.....	
Wilson—				
1910..	...	...	36	
NORTH DAKOTA.				
Grand Forks—				
1910..	2	4	.....	
OHIO.				
Bucyrus—				
1910..	2	4	.....	
Coshocton—				
1910..	...	...	.....	Buried.
E. Liverpool—				
1911..	...	...	.....	Decarie incinerator.
Lorain—				
1910..	3	6	3,000	
Massilon—				
1911..	...	...	.....	One.
Toledo—				
1910..	23	46	.....	80 ton reduction plant, built by company having 15 year contract.
Zanesville—				
1910..	3	5	.....	Decarie incinerator.
OKLAHOMA.				
Bartlesville—				
1910..	...	...	.....	Private.
1911..	...	...	.....	Planned to contract.
Clinton—				
1910..	2	...	40	
El Reno—				
1910..	3	6	30	
Muskogee—				
1911..	...	...	.....	$35,000.
Vinita—				
1911..	...	...	**1,000**	
PENNSYLVANIA.				
Chambersburg—				
1910..	5	Use fire-steamer horses.	15	
Corry—				
1910..	2	4	.....	
Easton—				
1910..	...	...	.....	Morse-Boulger type, 2 units, 17½ ton.
Franklin—				
1911..	...	...	.....	One.
Harrisburg—				
1910..	...	...	.....	Contract.
McKees Rock—				
1911..	...	...	.....	20-ton incinerator.
Pottsville—				
1910..	...	...	.....	Contract.
Reading—				
1910..	...	...	.....	Contract.

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
Swissvale—				
1910..	...	...	.....	Contract.
Wilkes-Barre—				
1910..	...	...	.....	Bennett Garbage Co.
Wilkinsburg—				
1910..	...	...	.....	Wilkinsburg Sanitary Co.
RHODE ISLAND.				
Pawtucket—				
1910..	...	...	.....	Contract.
Providence—				
1910..	24	50	.....	
SOUTH CAROLINA.				
Greenville—				
1910..	5	6	175	
Union—				
1910..	2	...	.....	
1911..	**2**	...	.....	
SOUTH DAKOTA.				
Deadwood—				
1910..	1	...	.....	
Lead—				
1910..	1	2	.....	
Pierre—				
1910..	1	2	150	
TENNESSEE.				
Columbia—				
1910..	2	2	1,000	
Memphis—				
1910..	73	67	.....	2 crematories. 3 dead animal wagons.
TEXAS.				
El Paso—				
1911..	...	...	.....	One incinerator. Plans by Public Works Construction Co.,
			.....	Portland, Ore.
UTAH.				
Salt Lake City—				
1910..	28	56	24	
1911..	**35**	**60**	**25**	

Cities	Wagons and Carts	Horses and Mules	Cans	Disposal plant
VERMONT.				
St. Albans—				
1910..	...	...	18	
VIRGINIA.				
Danville—				
1910..	13	13	.....	
WASHINGTON.				
Everett—				
1910..	...	...	.....	Garbage scow.
Puyallup—				
1910..	1	...	21	
Seattle—				
1910..	...	...	.....	Meldrum 74.4 tons per day. Total for 1910, 22,920. Are building additional 4-cell plant; will probably build another.
Spokane—				
1910..	16	35	3.000	Crematory.
WEST VIRGINIA.				
Charleston—				
1910..	...	...	.....	1 crematory.
Wheeling—				
1910..	7	...	.....	Decarie incinerator.
WISCONSIN.				
Milwaukee—				
1910..	95	95	.....	Milwaukee incinerator, Hering & Fuller, engineers.
CANADA.				
Kingston, Ont.—				
1911..	...	...	.....	Plans for complete system.
Toronto, Ont.—				
1910..	219	327	.....	1 crematory and dumps.

STREET SIGNS

The following table shows the kind of street signs used in modern and prospective marking of streets, and gives the number installed in 1910 and the number that will probably be put up during 1911. The number of kinds of material of which signs are made is remarkable.

The figures for 1911 are printed in heavy-faced type, that they may be distinguished readily:

Cities	Number	Kind
ARKANSAS.		
Fort Smith—		
1910..	1,100	Plain.
CALIFORNIA.		
Long Beach—		
1910..	700	Enamel.
Maysville—		
1910..	2,000	Wood.
Santa Cruz—		
1910..	200	Enamel, 600 wood.
S. Pasadena—		
1910..	40	Wooden posts, 4x4 in.
COLORADO.		
Florence—		
1910..	.....	Brass letters in cement sidewalk at corners.
CONNECTICUT.		
Ansonia—		
1910..	350	Blue enamel, white letters 3-in. high.
GEORGIA.		
Americus—		
1910..	150	Metal.
ILLINOIS.		
Canton—		
1910..	400	Blue enamel with white letters.
Collinsville—		
1910..	.....	Enamel signs.
Downers Grove—		
1910..	.....	Signs in concrete walks at street intersections.
Edwardsville—		
1910..	400	Enamel.
Galena—		
1910..	600	Wood.
Joliet—		
1910..	130	Tile letters set in sidewalk.
Progress	150	Tile.
Ottawa—		
1910..	.....	Metal, at all street intersections.
Paxton—		
1910..	.....	Iron board and post signs on all street corners.
	.....	

Cities	Number	Kind
Taylorville—		
1910..	.....	Wood at all street intersections.
Wheaton—		
1910..	300	Enamel steel.

INDIANA.

Auburn—		
1910..	125	Enameled.
Columbus—		
Progress	1,130	Painted.
Evansville—		
1910..	1,200	Cast-iron.
Indianapolis—		
1910..	22	Wooden.
Mishawaka—		
1911..	.....	Signs for outlying districts.
Rochester—		
1910..	300	Enamel.

IOWA.

Cedar Falls—		
1910..	425	Metal.
Des Moines—		
1910..	2	Brass letters in cement walks.
	500	Tile in cement walks.
	3,500	Wood.

KANSAS.

Arkansas City—		
1910..	.....	4-inch letters stamped in concrete sidewalks at every street intersection.

KENTUCKY.

Ashland—		
1910..	.....	Wood signs, and signs in concrete curbing.
Louisville—		
Progress	1,900	Enameled plates on wrought iron posts.

LOUISIANA.

Opelousas—		
1910..	386	Painted wooden.

MASSACHUSETTS.

Everett—		
1910..	335	Wood at every street corner.
Lowell—		
1910..	94	Painted on wood.
Quincy—		
1910..	200	Metallic.
Webster—		
1910..	75	Enamel.

MICHIGAN.

Grand Rapids—		
1910..	1,023	Steel.
Progress	639	Steel.
1911..	**639**	Steel.
Greenville—		
1910..	.....	Sign boards on gas pipe.
Kalamazoo—		
1910..	17,000	Enamel.
Negaunee—		
1910..	125	Steel enamel.

MINNESOTA.

Montevideo—		
1910..	100	Blue and white enamel.
St. Cloud—		
1911..	.....	Contemplated.

MISSOURI.

Kansas City—		
1911..	.....	Contemplated.
Libertyville—		
1910..	.....	4-inch white letters on blue ground, all street corners.
Moberly—		
1910..	.....	Galvanized iron signs, all street intersections.
Webb City—		
1910..	220	Wood signs, with tin letters.

MONTANA.

Cities	Number	Kind
Great Falls—		
1910..	.....	4-inch letters stamped in cement walks on all corners.
Lewiston—		
1910..	.....	Enamel signs on all street corners, and in cement walks.

NEBRASKA.

Elizabeth—		
1910..	.....	Enamel steel.
Hastings.		
1910..	.....	Common boards to each block.

NEW JERSEY.

Plainfield—		
1910..	56	Enameled iron on white boards.
1911..	**50**	Same.
Red Cloud—		
1911..	**12**	..
Rutherford—		
1910..	600	White enamel metal.

NEW YORK.

Buffalo—		
1910..	5,000	Cast-iron pipe or gas lamp posts.
Elmira—		
1910..	200	Wood, painted white on blue.
Syracuse—		
1910..	16	4-way Early electric signs.
	1,000	Blue enamel.
Watertown—		
1910..	300	Malleable cast iron, with raised letters, from Nichols Sign Co., Clyde, Ohio.

NORTH CAROLINA.

Greenville—		
1911..	**1,000**	Wood.
Hendersonville—		
1910..	500	Wood signs and posts.

NORTH DAKOTA.

Williston—		
1910..	208	Porcelain, blue background, white letters.

OHIO.

Alliance—		
1910..	150	
Cincinnati—		
1910..	1,000	Blue and white enamel.
Delaware—		
1911..	.....	Contemplated system.
E. Liverpool—		
1910..	400	Enameled signs.
Ironton—		
1910..	315	Porcelain iron.
Lancaster—		
1910..	300	Enameled iron.
Lorain—		
1910..	390	Enamel.
Wadsworth—		
1910..	72	Four-way signs.
1911..		Street signs and house numbering system.

OKLAHOMA.

Bartlesville—		
1910..	140	Blue enamel, with white letters.
Enid—		
1910..	500	Porcelain.
Muskogee—		
1911..	**400**	
Norman—		
1910..	200	Sheet iron painted.
Shawnee—		
1910..	50	Street name in curb.

PENNSYLVANIA.

Chambersburg—		
1910..	351	Furnished by E. C. Hayer, city.

Cities	Number	Kind
Doyleston—		
1910..	50	Iron.
Gallitzin—		
1911..	.....	Contemplated system.
Luzerne—		
1910..	100	Enameled.
Minersville—		
1910..	500	Blue enamel, with white letters.
Northeast—		
1910..	.....	Enamel, each street corner.
Oil City—		
1911..	**320**	Enameled.
Tyrone—		
1910..	.....	Enameled steel.
Wilkes Barre—		
1910..	1,500	Enamel.
Wilkinsburg—		
1910..	.....	Enamel signs tacked to buildings.
Williamsport—		
1910..	1,350	Galvanized iron.
RHODE ISLAND.		
Pawtucket—		
1911..	.....	Several hundred may be put up.
SOUTH CAROLINA.		
Greenville—		
1911..	**1,200**	Steel enameled
Union—		
1910..	400	
SOUTH DAKOTA.		
Sioux Falls—		
Progress	500	
TENNESSEE.		
Columbia—		
1910..	.....	Wood at all street intersections.
Memphis.—		
1910..	500	
UTAH.		
Salt Lake City—		
1910..	50	4-way metallic American sign.
1911..	**50**	Same.
WASHINGTON.		
Port Angeles—		
1910..	500	Wood.
WISCONSIN.		
Appleton—		
1910..	.....	Names in cement walks at street corners.
Beloit—		
1910..	.....	Enameled signs.
Waupun—		
1910..	.....	Complete new system.
CANADA.		
Toronto, Ont.—		
1911..	**1,000**	Enameled steel.

FIRE DEPARTMENT IMPROVEMENTS

The nature of the improvements reported for fire departments is such that they can not be classified in tables. The following items, arranged alphabetically by States and cities, give information as to such improvements made in 1910 and in contemplation for 1911. They include information as to new buildings, new steam and gasoline engines, chemicals, hose carts, ladder trucks, supply wagons, both horse-drawn and automobile; high pressure fire systems, horses, hose, fire alarm systems, wire, boxes, etc:

ALABAMA.

Jasper—1 building, 1 horse hose-cart, 1,800 ft. of hose comprise the present equipment.

ARKANSAS.

Ft. Smith—Purchased 4,000 ft. of hose in 1910. In 1911 will build $10,000 building, purchase two engines, horse or auto, one combination chief wagon, and chemical auto, and 7,000 ft. of hose.

CALIFORNIA.

Alhambra—In 1910, one auto fire-engine, one auto ladder-truck, 800 ft. of hose, 15 miles of wire, and a 30-box fire alarm system were purchased.

Antioch—In 1910, one thousand feet of hose were purchased. In 1911, one combination auto-apparatus will be added.

Coalinga—In 1911, a new city hall and fire-department building will be built.

E. San Jose—A new building was completed, and two hand-carts purchased in 1910.

Emoryville—A $9,733 fire engine house for automobile apparatus was completed.

Fresno—Present system comprises 7 buildings, 5 horse-drawn hose carts, 5 horse-drawn steam fire engines, 1 horse-drawn ladder-truck, 15,000 ft. of hose, and a 30-box Gamewell fire-alarm system.

In 1911, one new building will be built, and an auto-propelled steam fire engine will be purchased.

Lodi—In 1911, 2 horse-drawn hose carts, 1,200 ft. of hose, and 10-box alarm system will be purchased.

Long Beach—In 1910, 4 buildings were built, and the following equipment added: One horse-drawn hose wagon, 3 auto combination hose carts, one horse-drawn steam fire engine, one ladder-truck, one horse-drawn supply wagon, and a 28-box Gamewell alarm system. One auto gasoline fire engine has been ordered.

Maysville—The department comprises 1 building, 1 combination horse-drawn hose cart, 3 horse-drawn steam fire engines, 1 ladder-truck, 3,200 ft. of hose, and a 19-box Gamewell alarm system.

Palo Alto—In 1910, a 16-box Gamewell alarm system was installed.

An auto hose cart will be purchased in 1911.

Portersville—In 1911, one auto hose cart and one auto chemical engine will be purchased.

San Bernardino—In 1910, one new station was built, and one auto fire-truck added. A Gamewell alarm system is now being installed.

San Mateo—In 1911, 3 new buildings will be built, and an auto gasoline engine and 1,000 feet of hose will be added. A high-pressure system will be installed in business district.

Santa Clara—Fire service by direct pressure; no engines.

Santa Cruz—Two hose carts and two horses were added to the equipment in 1910.

Visalia—A four-piece department house was built in 1910, and the following equipment added: one horse-drawn hose cart, one horse-drawn steam fire engine, one ladder-truck, one horse-drawn chemical engine, 2,500 ft. of hose, and a 14-box Gamewell alarm system.

City will purchase auto fire engine in 1911.

CONNECTICUT.

Meriden—One Webb motor engine and $600 worth of hose were purchased in 1910. The fire alarm system comprises 43 boxes and 19 miles of wire.

FLORIDA.

Miami—Present system consists of 3 buildings, 2 hose carts, 1 ladder-truck, 1 supply wagon, 1 steam engine, all horse-drawn; 1 auto hose cart, 9,000 ft. of hose, and 24-box Gamewell alarm system.

GEORGIA.

Atlanta—The system includes 13 hose carts, 9 steam fire engines, 6 ladder-trucks, 1 water tower, 1 supply wagon, all horse-drawn; and 1 auto hose cart. One auto gasoline fire engine will be purchased in 1911. Twelve station houses and a 117-box Gamewell fire alarm system, with 100 miles of wire, complete the equipment for the city.

Cordele—The system comprises 1 building, 1 hose cart, 1 ladder-truck, 1 supply wagon, horse-drawn.

ILLINOIS.

Chicago Heights—In 1910, 1 central station was built and 2 horse-drawn steam engines added.

Collinsville—An $18,000 fire station was built in 1910.

A complete system, with equipment, to replace volunteer company, is being considered.

Danville—In 1910, 3,000 feet of hose was purchased.

In 1911, 1 building will be built, and 1 hose cart, and 1 gasoline fire engine, both auto-propelled, will be added.

Decatur—In 1910, 1 auto hose cart was purchased.

DeKalb—In 1910, 1,000 ft. of hose was purchased. A 4-box alarm system is being installed.

Downers Grove—The present system comprises 1 fire house, 2 hose carts, 1 ladder-truck, 3 fire wagons, all horse-drawn, and 2,000 feet of hose.

Freeport—A $5,000 building was built, and 1 horse-drawn hose cart, carrying 2,000 feet of hose, was purchased in 1910.

Galena—The present system includes 4 buildings, 3 hose carts, 1 ladder-truck, horse-drawn.

Galesburg—A horse-drawn American La France, Metropolitan, horse-drawn wagon, and 1,450 feet of hose were purchased in 1910.

A new building will be built in 1911.

Joliet—A new engine house will be built in 1911.

Moline—New fire station is being built.

Morton—New building, 1 ladder-truck, and 500 feet of hose were added in 1910.

Mt. Pulaski—Three Gamewell boxes and an extension ladder will be purchased in 1911.

Oak Park—The present system includes 2 buildings, 2 hose carts, 1 ladder-truck, horse-drawn, and 3,100 feet of hose, and 25-box Gamewell alarm system.

Ottawa—The present system includes 1 building, 2 hose carts, 1 supply wagon, 1 steam fire engine, all horse-drawn; 3,000 feet of hose, and a 23-box alarm system.

Paris—Purchased in 1910, 1,000 feet of hose.

Paxton—The system includes 2 hose carts, 1 ladder-truck and 1,700 feet of hose.

Peoria—The city bought in 1910, 3,000 feet of hose and a 78-box Gamewell fire alarm system, with 31 miles of wire. Three more boxes are being installed, and in 1911 1 $10,000 building, 5,000 feet of hose, and 1 truck, horse-drawn, will be added.

Rockford—One auto hose cart was purchased in 1910.

In 1911, 2 auto hose carts, 1 auto steam engine, 1 horse-drawn ladder-truck, and 1,500 feet of hose will be purchased.

Streator—One 2-wagon hose house, 1 hose wagon, and 1,500 feet of hose were added to the system in 1910.

Taylorville—The present system includes 1 building, 1 hose cart, 1 ladder-truck, 1 steam fire engine, all horse-drawn, and 1,600 feet of hose.

Waukegan—The department will build a new building and purchase auto hose cart in 1911.

Wheaton—One horse-drawn ladder-truck was purchased in 1910.

INDIANA.

Auburn—The present system includes 1 building, 1 combination ladder-truck, and hose cart, 6 chemical cans, 1,300 feet of hose, and 9 fire alarm boxes.

Columbia City—In 1910, 500 feet of hose and 1 horse-drawn ladder-truck were purchased.

Columbus—In 1911, 500 feet of hose and 1 fire alarm box will be purchased.

Converse—Present system comprises 1 building, 2 hose carts, and 1 steam fire engine, all horse-drawn.

Evansville—Present system comprises 12 buildings, 12 hose carts, 5 steam fire engines, 2 ladder-trucks, 2 supply wagons, all horse-drawn, and 14,000 feet of hose. The Gamewell fire alarm system includes 82 boxes and 35 miles of wire.

Ft. Wayne—The present system includes 8 buildings, and 8 hose carts, 3 ladder-trucks, 2 supply wagons, all horse-drawn. The Gamewell fire alarm system has been installed.

Hammond—The present system includes 5 hose carts, 2 steam fire engines, and 2 ladder-trucks, all horse-drawn, and 7,000 feet of hose. The Gamewell fire alarm system includes 35 boxes and 24 miles of wire.

Huntington—City purchased 500 feet of hose in 1910. In 1911, 1,000 feet of hose will be purchased.

Indianapolis—A $200,000 bond issue is under consideration for fire system additions and repairs.

Logansport—City purchased 1,000 feet of hose in 1910. In 1911, 1,000 feet of hose will be purchased.

Marion—The present system includes 3 hose carts, 2 ladder-trucks, 1 hose reel, all horse-drawn, and 11,000 feet of hose. The Gamewell system includes 41 boxes and 30 miles of wire.

Martinsville—The present system includes 3 hose carts, 1 ladder-truck, horse-drawn, and 1,500 feet of hose. In 1911, 1 auto steam fire engine will be purchased.

Mishawaka—A new hose-house is under construction, and a contract made with the American La France Fire Apparatus Co. for an auto truck.

Muncie—In 1910, 3 hose carts, one aerial truck, 1 50-h. p. and one 90-h. p. steam engine, all horse-drawn, were purchased. A 50-box Gamewell alarm system was installed.

New Castle—In 1910, 2 hose carts, 2,000 feet of hose, and 47 fire alarm boxes were purchased.

In 1911, 1 hose cart and 500 feet of hose will be added.

Peru—The present system includes 2 hose carts and 1 ladder-truck, horse-

drawn, 3,500 feet of hose, and a 15-box Gamewell alarm system.

Rochester—The present system consists of 1 building and combination chemical ladder-truck, horse-drawn.

Rushville—One box and 1 mile of wire were added to the Gamewell system in 1910.

In 1911, 3 boxes and 2 miles of wire will be added.

Sullivan—One hose cart and 1,000 feet of hose were purchased in 1910.

Veedersburg—The present department includes 2 hose carts, 1 ladder-truck, hand-drawn, and 1,600 feet of hose.

Warsaw—One chemical hose wagon, or truck, will be purchased in 1911.

IOWA.

Ames—In 1910, 500 feet of hose was purchased.

Burlington—The present system includes 4 hose carts, 3 hose wagons, 1 chemical engine, and 1 ladder-truck, all horse-drawn, 12,650 feet of hose, and a 43-box Gamewell alarm system.

Charles City—The present system includes 1 ladder-truck, 1,500 feet of hose.

Des Moines—Present system includes 15 hose carts, 5 ladder-trucks, all horse-drawn; 24,000 feet of hose, and 126-box Gamewell alarm system.

Eldora—Purchased 500 feet of hose in 1910.

Glenwood—The volunteer fire department has 2 hose carts, 1,000 feet of hose.

Grinnell—The city purchased 500 feet of hose in 1910.

Indianola—One ladder-truck was purchased in 1910.

Waterloo—City purchased 1,000 feet of hose in 1910.

In 1911, equipment for 2 sub-stations will be purchased.

KANSAS.

Argentine—The present system includes 1 hose wagon, 2,000 feet of hose, and a 9-box Gamewell fire alarm system.

Clay Center—City will purchase 500 feet of hose in 1911.

Olathe—City hall and fire department house is being built.

Pittsburg—The present system includes 2 hose carts, 1 ladder-truck, and 4-box fire alarm system.

Pratt—In 1910, 1 horse-drawn chemical combination wagon, and 700 feet of hose were purchased.

Salina—In 1910, 1 combination hose wagon and ladder-truck was purchased.

KENTUCKY.

Ashland—The present system includes 3 hose carts, and 1,230 feet of hose.

In 1911, 1,000 feet of hose will be purchased.

Louisville—Present system includes 16 hose carts, 23 steam fire engines, 7 ladder-trucks, 1 water-tower, 7 supply wagons, all horse-drawn; 7,500 feet of hose and a 360-box Gamewell alarm system. The equipment is housed in 28 buildings.

Maysville—City purchased Knox combination auto apparatus in 1910.

Paducah—Present system includes 6 hose carts, 1 steam fire engine, 2 ladder-trucks, 2 supply wagons, all horse-drawn; 11,000 feet of hose, and an 88-box Gamewell alarm system.

LOUISIANA.

Morgan City—Present system includes 3 hose carts, 2 steam fire engines, 1 supply wagon, all horse-drawn; and 2,000 feet of hose.

In 1911, city will build 1 new station, and will purchase 1 horse-drawn hose cart, with 500 feet of hose.

MAINE.

Lewiston—The present system includes 4 carts, 2 reels, 2 steam fire engines, 1 chemical engine, and 2 ladder-trucks, all horse-drawn; and 12,900 feet of hose, a fire alarm system of 52 boxes is to be extended by the addition of 30.

MARYLAND.

Annapolis—The city will purchase 1 gasoline auto fire engine in 1911.

MASSACHUSETTS.

Easthampton—City completed 1 hose house.

Everett—The present system includes 3 hose carts, 2 fire engines, 2 combination motor trucks, 3 supply wagons, all horse-drawn; 6,400 feet of hose, and a 66-box Gamewell and Stevens alarm system.

Lowell—In 1910, 1 auto hose cart, 2,000 feet of hose, 2 Gamewell fire alarm boxes, and 44 miles of wire were purchased.

Quincy—The system comprises 5 hose carts, 3 combination hose carts, a steam fire engine, a ladder-truck, 4 supply wagons, all horse-drawn; 12,000 feet of hose, 6 buildings, and a 96-box Gamewell fire alarm system, with 2 miles of wire. An auto combination hose wagon will be purchased in 1911.

Revere—In 1911 a central station will be built.

Webster—One combination chemical and hose cart was purchased in 1910.

MICHIGAN.

Alpena—One building is being constructed.

Battle Creek—In 1911, 1 auto hose cart will be purchased.

Bessemer—1,000 feet of hose was purchased.

Flint—One combination auto-propelled chemical and hose cart, and 1 chief's chemical auto were purchased.

Gladwin—500 feet of hose will be purchased in 1911.

Hancock—The present system includes 2 hose carts, 1 steam fire engine, 1 ladder-truck, and 22 fire alarm boxes. A new station is now being constructed.

Highland Park—One auto steam fire engine has been ordered.

Kalamazoo—One station has been constructed in 1910.

Negaunee—The present system includes 2 hose carts, 1 steam fire engine, 1 ladder-truck, all horse-drawn; 4,000 feet of hose, and a 10-box Gamewell alarm system.

Norway—The city will purchase 1 hose wagon and 3 fire alarm boxes in 1911, and is contemplating the purchase of an auto truck.

Port Huron—One building was constructed and 500 feet of hose purchased in 1910.

Rochester—The city will purchase 250 feet of hose in 1911.

Saginaw—The city has purchased 1,500 feet of hose and extended the Gamewell alarm system one mile in 1910.

Three Rivers—The city purchased 500 feet of hose in 1910.

MINNESOTA.

Amboy—The present system includes 2 hose carts and 1,000 feet of hose.

Crookston—City purchased 1,500 feet of hose in 1910.

Faribault—City will purchase 500 feet of hose in 1911.

Mankato—City will purchase 1,000 feet of hose in 1911.

New Ulm—City has installed a 3-box Gamewell alarm system.

Red Wing—City has one gasoline auto fire engine and 1 horse-drawn water tower.

St. Cloud—City will build $15,000 station in 1911.

Virginia—City will purchase 1 auto hose cart.

Winona—The present system includes 4 hose carts, 2 ladder-trucks, 1 supply wagon, all horse-drawn.

MISSISSIPPI.

Yazoo City—The city has purchased 4,000 feet of hose, and will purchase 5,000 additional in 1911.

MISSOURI.

Aurora—The city will purchase an auto hose cart in 1911.

Fulton—The city purchased 500 feet of hose in 1910, and has under construction a 5-box fire alarm system.

Independence—The city purchased 1 ladder-truck and 500 feet of hose in 1910.

Kansas City—City purchased 10,000 feet of hose and 21 miles of wire for police and fire alarm system.

In 1911, 5 stations will be built, and 3 combination chemical wagons will be purchased.

Libertyville—The present system includes 2 hose carts, 1 ladder-truck, 1 supply wagon, all horse-drawn, and 1,700 feet of hose.

Webb City—The present system includes 1 hose wagon, 1 ladder-truck, horse-drawn; 1 auto hose cart, and 2,000 feet of hose.

MONTANA.

Billings—The present system includes 2 auto hose carts, 1 horse-drawn ladder-truck.

Bozeman—The city installed a 19-box Gamewell alarm system in 1910.

In 1911, 1 auto hose cart and 500 feet of hose will be purchased.

Butte—The present system comprises 4 hose wagons, 2 ladder-trucks, 1 supply wagon, all horse-drawn; 3 buildings, 13,000 feet of hose, and a 65-box Gamewell fire alarm system, with 31 miles of wire.

Deer Lodge—The present system includes 3 hose carts, 1 steam fire engine, 1 ladder-truck, all horse-drawn; and 2,500 feet of hose.

Glasgow—The city will purchase 500 feet of hose in 1911.

Great Falls—The city purchased 1 80-h. p. gasoline auto combination hose, ladder, and chemcial wagon from the Seagraves Co. in 1910.

The complete system includes 2 hose carts, 1 combination hose and ladder, horse-drawn; 1 cheif's auto, 7,400 feet of hose, and 21-box Gamewell fire alarm system.

Lewiston—The present system includes 2 hose carts, 1 ladder-truck, horse-drawn; 2,600 feet of hose, and 7-box Gamewell alarm system.

NEBRASKA.

Chadron—The city will purchase 600 feet of hose in 1911.

Hastings—The present system includes 2 horse-drawn hose carts, and 3,000 feet of hose.

S. Omaha—The city purchased 2 hose carts, 1 steam fire engine, 1 ladder-truck in 1910, and is building 2 new fire stations.

Wymore—The city will purchase 500 feet of hose in 1911.

NEVADA.

Reno—The Gamewell fire alarm system was extended by addition of 8 boxes, making 46 boxes in all.

Automobile apparatus is being considered for 1911.

NEW HAMPSHIRE.

Antrim—The present system includes 1 hose cart, 1 ladder-truck, and 1,550 feet of hose.

NEW JERSEY.

Bayonne—One auto combination chemical and hose wagon, 2,000 feet of hose, and 5 additional boxes for the Gamewell alarm system, were purchased in 1910.

Elizabeth—The present system includes 6 hose carts, 6 fire wagons, 2 ladder-trucks, and 3 supply wagons, all horse-drawn, and a 100-box Gamewell fire alarm system.

Garfield—The present system includes 5 hose carts and 1 ladder-truck, horse-drawn, and 2,500 feet of hose.

Irvington—The city purchased 2 hose carts and 1 auto hose cart in 1910.

Melville—A new station will be built and 1,000 feet of hose purchased in 1911.

Ocean City—One auto combination chemical and hose wagon, and 1,000 feet of hose were purchased in 1910.

In 1911, 500 feet of hose will be purchased.

Plainfield—The present system includes 1 steam fire engine, 1 ladder-truck, and 2 supply wagons, horse-drawn; 2 combination hose and chemical wagons, 8,000 feet of hose, and a 48-box Gamewell fire alarm system.

Rutherford—The present system includes 3 hose carts, and 1 ladder-truck, horse-drawn; 6,000 feet of hose, and a 25-box Gamewell alarm system.

NEW MEXICO.

Silver City—The present system includes 3 hose carts, and one ladder truck, horse-drawn, and one auto chemical engine.

NEW YORK.

Amsterdam—At present 1 building is in progress. In 1910, 1,500 feet of hose was purchased; the purchase of 1,000 additional feet is under consideration.

Binghamton—The present system includes 8 hose carts, 3 steam fire engines, 2 ladder-trucks, 4 supply wagons, all horse-drawn; and 1 auto supply wagon, 11,000 feet of hose and a 107-box Star electric alarm system.

Buffalo—The present system includes 33 steam fire engines, 3 steam fire boats, 31 two-horse hose wagons, 6 combination hose and chemical wagons, 7 chemical engines—two horse, 13 hook and ladder trucks, 2 water towers, 35 exercise wagons, 30 hose sleighs, 258 horses, 86,850 feet of 2½-inch hose, 14,300 feet of 3½-inch hose, 11 officer's wagons, 9 officer's sleighs, and a 720-box Gamewell fire alarm system, with 550 miles aerial wire, 6 ½ miles aerial cable, and 44 miles underground cable.

Elmira—The city purchased 1,000 feet of hose in 1910.

In 1911, 1 horse-drawn hose cart, 500 feet of hose, and 1 Gamewell fire alarm box will be purchased.

Frankfort—The present system includes 8 hose carts, 1 ladder truck, hand-drawn; 1 steam fire engine, horse-drawn, and 2,500 feet of hose.

Herkimer—In 1910 2 fire alarm boxes, with 8,920 feet of wire, were installed.

Middleton—In 1910 1 auto fire engine and 1,000 feet of hose were purchased, and 1 department house built.

Olean—The city has purchased 1 auto hose cart, 1 horse supply wagon and 6 fire alarm boxes.

Oneida—The city has purchased 1,000

feet of hose in 1910, may buy a like amount in 1911.

Salamanca—The city purchased 500 feet of hose, 20 Gamewell fire alarm boxes and 7 miles of wire in 1910.

In 1911 they will purchase one horse-drawn ladder truck, 800 feet of hose, 10 fire alarm boxes and 4 miles of wire.

Solvay—The present system includes 3 hand hose carts, 3,000 feet of hose and a 12-box Gamewell fire alarm system.

Syracuse—In 1910 city purchased 2,500 feet of hose and 2 fire alarm boxes.

In 1911 will purchase 2,500 feet of hose, 1 horse-drawn ladder truck and a complete new fire alarm system.

Troy—The present system includes 13 hose carts, 11 steam fire engines, 3 ladder trucks, 13 supply wagons, all horse-drawn; 21,000 feet of hose, 15 buildings, and a complete Gamewell system.

In 1911 the city will purchase one hose cart, one steam fire engine, one ladder truck, all horse-drawn; 4,000 feet of hose, and complete new fire alarm system.

Utica—The city purchased 2 Gamewell fire alarm boxes and 2 miles of wire in 1910.

In 1911, 1,500 feet of hose will be purchased, and a central fire station built.

NORTH CAROLINA.

Greenville—The city purchased 1,000 feet of hose in 1910. The complete system includes 2 hose carts, 1 steam fire engine, 1 ladder truck, 3 water towers, 2 supply wagons, all horse-drawn, and 4,000 feet of hose.

In 1911, two hose carts and 1,000 feet of hose will be purchased.

Wilson—The city purchased 500 feet of hose in 1910.

NORTH DAKOTA.

Bismarck—The city purchased 1,000 feet of hose in 1910.

Grand Forks—The city purchased 1,000 feet of hose in 1910.

Jamestown—The city will purchase a horse-drawn ladder truck in 1911.

Minot—The city will purchase 500 feet of hose in 1911.

Wahpeton—The city will purchase 500 feet of hose in 1911.

Willistown—The city purchased 1,000 feet of hose in 1910.

OHIO.

Ashtabula—The city has purchased 2 auto hose carts.

Bucyrus—The present system includes 3 hose carts, 1 steam fire engine and 1 ladder truck, all horse-drawn; 3,500 feet of hose and a 16-box Gamewell fire alarm system.

Canal Dover—The city has received bids for the purchase of 500 feet of hose. An automatic bell-striker will be installed in 1911.

Cincinnati—The present system is housed in 47 buildings, and includes 44 hose carts, 36 steam fire engines, 16 ladder trucks, 2 water towers, 4 supply wagons, all horse-drawn, and a complete Gamewell system. One service ladder truck was purchased in 1910. Three new sttaion houses will be erected in 1911.

Cleveland Heights—The city has purchased 2 hose carts and 800 feet of hose in 1910.

Conneaut—The city will purchase 1,000 feet of hose in 1911.

Coshocton—The present system includes one hose cart, one ladder truck, 2,700 feet of hose, and 21-box Gamewell alarm system.

Delaware—The present system includes 2 hose carts, 1 steam fire engine, 1 ladder truck, 1 supply wagon, all horse-drawn, and 4,000 feet of hose.

East Cleveland—The city will purchase an auto-gasoline fire engine and fire alarm system in 1911.

East Liverpool—The present system includes 4 hose carts, 1 steam fire engine, 1 ladder truck, 1 supply wagon, all horse-drawn; 3,500 feet of hose and a 68-box Gamewell fire alarm system.

In 1911 1,000 feet of hose will be purchased and the alarm system extended one mile.

Ironton—The city will purchase 500 feet of hose in 1911.

Leotonia—The city will purchase one hose cart and 500 feet of hose in 1911.

Lorain—The present system includes 7 hose carts, 3 steam fire engines, 1 ladder truck and 3 supply wagons, all horse-drawn.

In 1911 the city will purchase 2 gasoline auto fire engines and 1 auto ladder truck.

Napoleon—The present system includes 1 combination hose wagon, 1 steam fire engine and 1 ladder truck, all horse-drawn, and 3,100 feet of hose.

Port Clinton—The city will build a $25,000 town hall and fire department building in 1911.

Steubenville—The city will build 1 station house in 1911.

Warren—The city proposes to purchase motor combination chemical and hose truck and sell 2 horse-drawn trucks.

Zanesville—The present system includes 4 hose reels, 4 combination hose wagons and 1 ladder truck, all horse-drawn; 8,200 feet of hose and an 80-box Gamewell fire alarm system.

In 1911 one station house will be built and one auto steam fire engine purchased.

OKLAHOMA.

Bartlesville—The present system consists of 1 hose cart, 1 7,600-pound, 600-gallon-per-minute steam engine, 1 ladder truck, all horse-drawn; 3,300 feet of hose and a 15-box Gamewell fire alarm system, and American-La France auto chemical, hose and ladder is now being constructed.

Chandler—The city purchased 1,000 feet of hose in 1910.

Clinton—In 1911 the city will build 1 fire station, and will purchase 1 horse-drawn hose cart, 2,000 feet of hose and 20-box fire alarms system.

El Reno—The city purchased 1 ladder truck and 2,500 feet of hose in 1910.

Enid—The present equipment includes 1 hose cart, 1 steam fire engine, 1 ladder truck, 1 water tower, all horse-drawn; 1 auto hose cart, 3,000 feet of hose and a 20-box Gamewell fire alarm system.

Guthrie—In 1910 the city purchased 1 hose cart, 1 steam fire engine and 1 ladder truck, all horse-drawn, and 3,300 feet of hose.

Lawton—The present equipment includes 1 ladder truck, 1 supply wagon and 5,000 feet of hose.

In 1911 1 auto ladder truck will be purchased.

Muskogee—The present system includes 1 hose cart, 1 steam fire engine, 1 chief's wagon, all auto-propelled, and 2 steam fire engines, 1 ladder truck, horse-drawn; 5,800 feet of hose and a 45-box Gamewell alarm system.

In 1911 1 hose cart, 1 auto hose cart, 1 auto steam fire engine and an additional 5,000 feet of hose will be purchased.

Norman—The present equipment in-

cludes one hose-and-ladder truck and 2,000 feet of hose.

Shawnee—Will purchase 1 auto steam fire engine and 500 feet of hose in 1911.

PENNSYLVANIA.

Aspinwall—The city will purchase in 1911 2 hose carts, 2 ladder trucks and 300 feet of hose.

Bellwood—The city purchased 1 hose cart and 500 feet of hose in 1910.

Chambersburg—The present system includes 3 hose carts, 2 steam fire engines, horse-drawn; 1 gasoline fire engine, auto-propelled; 3,000 feet of hose and a 23-box Gamewell alarm system.

In 1911 the city will purchase 1 auto hose cart.

Chester—The present equipment includes 1 hose cart, 3 steam fire engines, 2 ladder trucks, 4 supply wagons, all horse-drawn.

Corry—The present equipment includes 1 hose cart, 1 combination hose and chemical wagon, both horse-drawn; 3,700 feet of hose and a 6-box Gamewell alarm system.

In 1911 1,000 feet of hose and 3 alarm boxes will be purchased.

Doyleston—The present equipment includes 2 hose carts, 1 ladder truck, 1 supply wagon, all horse-drawn, and 2,000 feet of hose.

Harrisburg—The present system includes 43 hose carts, 3 ladder trucks, 1 supply wagon, all horse-drawn; 15,000 feet of hose and a 65-box Gamewell alarm system.

Northeast—The present system includes 3 hose carts, 1 ladder truck, both horse-drawn, and 2,500 feet of hose.

Oil City—City has purchased 1 auto hose cart.

Pottsville—In 1910 3 boxes and 2 miles of wire were added to the Gamewell system.

In 1911 1 gasoline auto-propelled fire engine, 2,000 feet of hose, 1 alarm box and 1 mile of wire will be purchased.

Swissvale—The city will purchase 1,200 feet of hose in 1911.

Wilkinsburg—The present system includes 1 hose cart, 1 ladder truck, both horse-drawn; 2,000 feet of hose and a 30-box Gamewell alarm system.

RHODE ISLAND.

East Providence—The volunteer company now possesses 4,500 feet of hose. An auto-propelled hose cart is being constructed.

Pawtucket—The present system includes 7 hose carts, 2 steam fire engines, 4 ladder trucks, 6 supply wagons, all horse-drawn; 16,000 feet of hose and a 131-box Gamewell fire alarm system. An auxiliary automobile was purchased in 1910.

Providence—The present equipment includes 24 hose wagons, 17 steam fire engines, 11 ladder trucks, 1 water tower, 27 supply wagons, all horse-drawn; 40,000 feet of hose and a 456-box Gamewell fire alarm system.

SOUTH CAROLINA.

Florence—In 1910 1 gasoline, auto-propelled fire engine was purchased.

Greenville—The present equipment includes 3 hose carts, 1 steam fire engine, 2 ladder trucks, 1 supply wagon, all horse-drawn; 1 auto hose cart and 2,000 feet of hose.

In 1911 a complete fire alarm system will be installed.

Union—In 1910 the city purchased 1 hose cart, 1 supply wagon, 2,500 feet of hose and 4 fire alarm boxes.

SOUTH DAKOTA.

Aberdeen—The city purchased 1 horse-drawn steam fire engine in 1910.

Lead—The city purchased 1,500 feet of hose, 15 fire alarm boxes and 2 miles of wire in 1910.

In 1911 1,000 feet of hose will be purchased.

Rapid City—One hose house was completed in 1910.

Sioux Falls—The city will build fire stations costing $35,000.

TENNESSEE.

Columbia—The city completed 1 central station and installed 1 combination wagon, 3 horses and 3 carts in 1910.

Knoxville—The present equipment includes 5 combinationtion hose wagons, 1 hose wagon, 1 reel, 5 steam fire engines, 1 ladder truck, 1 water tower, 1 supply wagon, all horse-drawn; 11,500 feet of hose and a 73-box Gamewell fire alarm system.

Rockwood—The city purchased 500 feet of hose in 1910.

TEXAS.

Denison—In 1910 the city purchased 1 auto chemical wagon and 1,500 feet of hose.

In 1911 1 auto chemical engine, 1 horse-drawn steam fire engine and 1,000 feet of hose will be purchased.

El Paso—The present equipment includes 6 hose carts, 3 steam fire engines, 1 ladder truck and 1 supply wagon, all horse-drawn; 1 auto hose cart, 8,500 feet of hose and a 75-box Gamewell alarm system.

Greenville—The present equipment includes 2 hose carts, 1 steam fire engine and 1 ladder truck, all horse-drawn.

UTAH.

Ogden—In 1910 the city purchased 1 auto gasoline fire engine.

In 1911 city will purchase 1 auto-propelled steam fire engine, 1 horse-drawn ladder truck and a 10-box fire alarm system.

Salt Lake City—The present system includes 7 hose wagons, 3 steam fire engines, 4 ladder trucks and 1 supply wagon, all horse-drawn; 20,000 feet of hose and a 75-box privately-owned fire alarm system.

VERMONT.

Bellows Falls—The city will purchase 1 horse-drawn ladder truck and 1,000 feet of hose.

VIRGINIA.

Chatham—In 1911 the city will purchase 1 auto gasoline fire engine.

Danville—The present equipment includes 2 hose carts, 3 steam fire engines, 1 ladder truck and 1 supply wagon, all horse-drawn, and 4,000 feet of hose.

WASHINGTON.

Bellingham—The present equipment includes 1 hose wagon, 1 steam fire engine and 2 combination chemical wagone, all horse-drawn; 7,000 feet of hose and a 49-box Gamewell fire alarm system.

Hoquiam—The present system includes 3 hose carts, 2 fire engines, 3 ladder trucks, all horse-drawn; 8,000 feet of hose and a 26-box Gamewell fire alarm system.

Port Angeles—The present system includes 1 hose cart, 1 gasoline fire engine, 1 ladder truck, 1 chemical engine, all horse-drawn, and 1,000 feet of hose.

Pullman—The city purchased 3 hose carts and 800 feet of hose in 1910, and

will probably install a complete fire alarm system in 1911.

Puyallup—The present system includes 2 hose carts and 1,000 feet of hose.

South Yakima—The city will purchase an auto-propelled gasoline fire engine in 1911.

Spokane—The present equipment includes 9 hose carts, 7 steam fire engines, 3 ladder trucks, 1 supply wagon, all horse-drawn; 1 auto hose cart and 1 auto chemical engine, 24,000 feet of hose and a 268-box Gamewell fire alarm system.

Walla Walla—The city purchased an 80-h. p. Seagrave combination wagon and 3,000 feet of hose in 1910.

In 1911 3,000 feet of hose will be purchased.

WEST VIRGINIA.

Fairmont—The city will purchase 1,000 feet of hose in 1911.

Wheeling—In 1910 the city purchased 5,500 feet of hose and 1 supply wagon.

WISCONSIN.

Appleton—The city purchased 1 steam fire engine in 1910.

Burlington—The city purchased 600 feet of hose in 1910.

DePere—The city purchased 600 feet of hose in 1910.

Eau Claire—The city purchased in 1910 one 30-gallon chemical wagon and 1½ miles of wire.

Hartford—The city purchased 500 feet of hose in 1910.

Milwaukee—The system includes 25 hose carts, 25 steam fire engines, 13 ladder trucks, 1 water tower and 4 supply wagons, all horse-drawn; 34 buildings, 93,000 feet of hose and a 675-box Gamewell fire alarm system, with 741 miles of wire. Two new buildings are in prospect.

Port Washington—The city will purchase 2,000 feet of hose in 1911.

Stevens Point—The present equipment includes 3 hose carts, 1 steam fire engine, 1 ladder truck, 1 water tower, all horse-drawn; 2,000 feet of hose and a 200-box fire alarm system.

Waupaca—The city purchased 500 feet of hose in 1910.

Waupun—The city purchased 1 ladder truck and 500 feet of hose.

Wausau—The present equipment includes 4 hose carts, 2 steam fire engines, 1 ladder truck, all horse-drawn; 8,000 feet of hose and a 43-box Gamewell alarm system.

CANADA.

Winnipeg, Man.—In 1910 the city purchased 1 auto hose cart, 5,500 feet of hose, 17 fire alarm boxes and 59 miles of wire. There are under construction 15 fire alarm boxes, including 25 miles of wire.

In 1911 the city will purchase 2 auto hose carts, 1 horse-drawn ladder truck and 1 supply wagon, 5,000 feet of hose, 15 fire alarm boxes and 20 miles of wire.

Kingston, Ont.—In 1910 the city purchased 1 hose wagon, 1 hose sleigh and 1 600-gallon steam fire engine.

In 1911 1 ladder truck and sleigh, 500 feet of hose and 5 fire alarm boxes will includes 74 pieces of apparatus, 9 steam fire engines, 22 fire stations, 105 horses be purchased.

Toronto, Ont.—The complete system and 261 officers and men.

ORGANIZATIONS AND INDIVIDUALS

Indiana Sanitary Association—South Dakota Engineers—Technical Associations—Calendar—Personal Notes

Indiana Sanitary and Water Supply Association.

The February convention of the Indiana Sanitary and Water Supply Association was one of the most interesting and valuable which it has been the fortune of the writer to attend. The proceedings will be published, and can be obtained of the president, Frank C. Jordan, Indianapolis. Two of the practical papers are published in this number of MUNICIPAL ENGINEERING, and others will appear later.

Free water and public service commissions were two interesting subjects of discussion. State and city health officers were on the program. Ex-vice president C. W. Fairbanks discussed conservation of forests, Geo. W. Fuller discussed the value of pure water, Prof. R. L. Sackett described French installations for purification of water by ozone. Joseph W. Ellms showed the construction of the Cincinnati filtration plants. The Southern Chicago drainage plan, the pollution of Lake Michigan, the care of hydrants, the flushing of streets were subjects in competent hands, which will be given in detail in later numbers.

Frank C. Jordan was elected president, and W. F. King, secretary, both of Indianapolis.

South Dakota Society of Engineers and Surveyors.

The second annual meeting of the South Dakota Society of Civil Engineers and Surveyors was held in the offices of the state engineer at Pierre, on January 25, 1911. Many prominent engineers were in attendance from all sections of the State.

President S. B. Howe, of Sioux Falls, presided. Among the addresses given were the following: "The Function of the County Surveyor," by U. S. Griggs, for-

mer state surveyor; "The Duties of the State Surveyor," by B. E. Lovejoy, former city engineer of Redfield; "The Filing of Plats of Records," by R. E. Easton, city engineer of Aberdeen, S. D.; "The Problems of the City Engineer," by S. B. Howe, city engineer of Sioux Falls.

The officers elected for the ensuing year are: President, S. B. Howe, Sioux Falls; vice president, B. E. Lovejoy, Redfield; secretary-treasurer, R. B. Easton, Aberdeen.

The International Municipal Congress and Exposition.

The management of the International Municipal Congress and Exposition, to be held in Chicago, September 18 to 20, 1911, has issued a handsomely executed prospectus which outlines the purposes and plans of the exposition and show.

The purpose of the congress and exposition is the betterment of municipalities throughout the civilized world, morally, artistically and physically; to illustrate the needed educational forces to accomplish this result, and to show examples of what has been done.

Among the subjects which have been decided upon for discussion and exhibit are the following: Charters and forms of government, municipal accounting, paving and the care of streets, road-making, parks and playgrounds, health and sanitation, taxation, charities and correction, home rule, public utilities, city planning, civic organizations, commercial organizations, schools, police and fire, libraries, municipal statistics, and varied exhibits.

Technical Associations.

The annual meeting of the Ontario Land Surveyors was held in the lecture room of the Engineers' Club of Toronto, on February 28 to March 2, inclusive.

The February meeting of the New England Water Works Association was held at the Hotel Brunswick, Boston, on February 8. The papers presented at this meeting were: "Construction Work on the Water Supply of New York City," by J. Waldo Smith, chief engineer, and "The Use of the Salinometer in Studies of Sewage Disposal by Dilution," by Kenneth Allen, chief engineer of the Metropolitan Sewerage Commission, New York.

The annual meeting of the Appalachian Engineering Association was held at Pottsville, Pa., on February 24-25. The program and entertainment were in charge of Capt. Baird Halberstadt, F. G. S., and Frank A. Hill. Prof. Henry Mace Payne, Morgantown, W. Va., is secretary.

At the meeting of the Montana Society of Engineers, held at Helena, on January 14, the following officers were elected: President, F. W. Whyte; first vice president, R. A. McArthur; secnd vice president, J. H. Klepinder; secretary, C. H. Moore; treasurer, Samuel Barker, Jr.

At the convention of the Iowa Cement Users, at Cedar Rapids, Ia., on January 13, the following officers were elected: President, J. W. Budd, Des Moines; first vice president, C. C. Merillat, Winfield; second vice president, H. H. Dean, Payne; treasurer, G. E. Tathwell, Waterloo; secretary, Ira A. Williams, Ames.

"The Geology of New York City in Its Relation to Engineering Problems" was the title of a paper by Charles P. Berkey, professor of geology, Columbia University, and John R. Healy, at the regular meeting of the Municipal Engineers of the City of New York, on February 21, 1911.

At the annual meeting of the Iowa Engineering Society, held at Des Moines, on February 15, 16 and 17, the following were among the papers presented: "Practical Points on Sewer Construction," by Lowell H. Stone; "Does the Boulevard Lighting System Pay," by Austin Burt; "Relative Merits of the Different Kinds of Pavements in Use Throughout the State," by Monroe L. Patzig, and "Cement Concrete Paving in Mason City," by Fred P. Wilson.

A paper on "The Pavement Problem in the Borough of Manhattan," by Daniel B. Goodsell, was presented before the Brooklyn Engineers' Club at a regular meeting on February 9.

The Oregon Society of Engineers was organized at a meeting held in the rooms of the Commercial Club of Portland, on February 6, 1911.

The Manufacturers of Corrugated Steel Culverts in the Northwestern States held their first annual convention in Minneapolis, Minn. The officers of the association are: President, T. M. Thompson; vice president, B. W. Harris; secretary-treasurer, N. V. Lux. The purpose of the organization is to standardize the gauge and weight of metal, in order to obtain equitable freight rates for their products.

The annual convention of the Wood Preservers' Association was held at the Auditorium Hotel, Chicago, January 17 to 19. A number of very interesting papers were presented, and the following officers were elected: President, J. T. Logan, of the National Lumber & Creosoting Co., Texarkana, Tex.; secretary-treasurer, F. J. Angier, timber-treating engineer of the Kettle River Co. (re-elected). The next annual meeting will be held in Chicago.

The Maine Society of Civil Engineers was organized in the rooms of the State Highway Commission, Augusta, on January 17. The following officers were elected: President, Cyrus C. Babb, Augusta; vice president, Walter H. Sawyer, Lewiston; secretary, Frank E. Pressey, Bangor; treasurer, H. S. Boardman, Orono.

The annual convention of the Carolina Municipal Association was held in the rooms of the Commercial Club, Raleigh, N. C., on January 18 and 19. The following officers were re-elected for the ensuing year: President, Fred N. Tate, High

Point; first vice president, James D. McNeill, Fayetteville; second vice president, T. W. Hawkins, Charlotte; third vice president, O. B. Eaton, Winston; fourth vice president, J. S. Wynne Raleigh; fifth vce president, W. D. LaRoque, Jr., Kinston; sixth vice president, W. G. McRae, Wilmington; secretary-treasurer, Thomas D. Meares, Wilmington.

The Manufacturers' Library, a free reading room and reference catalogue, a club house with all the accessories of telephones, stenographers and private rooms for business appointments, with many conveniences new and peculiar to itself, has recently been opened in the Hudson Terminal Building, No. 50 Church st., New York City.

The Association Francaise du Froid, 10 Rue Denis-Poisson, Paris, France, has issued a program of conditions on which it will grant a diploma of Refrigeration Engineer.

Officials and citizens of Fayette county, Pa., met February 11 to form an association to help secure state aid for the county roads and to stimulate interest in better roads.

The Building Trades Employers' Association of New York has announced the award of nine prizes for designs for small houses.

The special committee on "Bituminous Materials for Road Construction" of the American Society of Civil Engineers, Arthur H. Blanchard, Providence, R. I., secretary, has issued its blanks for reports for 1911, which will be sent on request to any engineer who will supply the information desired. The state of knowledge on this subject is as yet so indefinite that all engineers who have had experience, no matter how slight, should send for the blanks and use them.

Calendar of Technical Meetings.

Canadian Cement and Concrete Association. Annual convention, Toronto, Ont. Wm. Snaith, secretary, 57 Adelaide st., East Toronto, Ont. March 6-11.

New England Water Works Association. March meeting, Hotel Brunswick, Copley Square, Boston. Willard Kent, secretary, Narragansett Pier, R. I. March 8.

American Railway Engineering and Maintenance of Way Association. Annual convention, Chicago, Ill. E. H. Fritch, secretary, 962 Monadnock Block, Chicago, Ill. March 21-23.

National Electric Light Association. Annual convention, Engineering Societies Building, New York, N. Y. May 29 to June 3.

American Water Works Association. Annual convention, Rochester, N. Y. J. M. Diven, secretary, 14 George st., Charleston, S. C. June 6-10.

International Association of Chiefs of Police. Eighteenth annual convention, Rochester, N. Y. Major Richard Sylvester, superintendent of police, Washington, D. C., president. June 11-16.

New York State Association of Chiefs of Police. Annual convention, Rochester, N. Y. June 13-18.

Personal Notes.

C. L. Bernay, assistant city engineer of Houston, Tex., has accepted a position in the Texas Company's asphalt division.

F. E. Semon, formerly assistant to City Engineer Foster, of Medford, Ore., has been appointed city engineer of Ashland, Ore.

J. W. Paxton, a civil engineer of Norfolk, Va., has been appointed superintendent of street cleaning of Washington, D. C.

Alberto Schreiner has been appointed assistant engineer in charge of the bureau of design in the sewer department of the Borough of Queens, City of New York.

James H. Fuertes, consulting engineer, of New York City, has been retained by the city of Cumberland, Md., to report reupon a $500,000 water works system for that city.

N. B. Buchanan has established a general consulting engineering practice, with offices at Huntsville, Ala. He had lately served as assistant resident engineer for the U. S. Steel Corporation.

Dwight Horton, Assoc. M. Am. Soc. C. E., has left the J. W. Maxcy Co., of Houston, Tex., to enter a partnership with F. D. Horton under the firm name of F. D. Horton & Son, to engage in a general contracting business, with headquarters at Houston, Tex.

Gerardo Immediato, Assoc. M. Am. Soc. C. E., has been appointed by the town council of Montclair, N. J., to the newly-created position of town engineer. Mr. Immediato was formerly assistant engineer of the Monterrey water works at Monterrey, Mexico.

Frederick G. Clapp, consulting geological engineer, of Pittsburg, Pa., has decided to specialize in coal work. For this purpose C. V. Gould, who is a graduate mining engineer from Durham University, England, has become associated with Mr. Clapp in his practice.

James L. Tighe, M. Am. Soc. C. E., who has served the city of Holyoke, Mass., for the past 19 years as engineer of the city water works and as city engineer, has opened an office in the Caledonian Building, Holyoke, for practice as a consulting engineer, giving special attention to hydraulic and municipal engineering.

The estate of William H. Bryan, of St. Louis, Mo., has recently sold to the well-known consulting engineer, Henry Floy, of New York, the late Mr. Bryan's complete reference file on depreciation of engineering apparatus and structures. Mr. Bryan's standing as an engineer and his wide experience in making valuations and appraisals enabled him to make up one of the most complete collections of data relating to depreciation.

It has been announced that Oscar Claussen has been appointed to succeed L. W. Rundlett as city engineer of the city of St. Paul, Minn. Mr. Claussen, who is at present engaged in consulting work, was at one time city engineer, serving from 1899 to 1902. He has for some time been more actively engaged in railroad work. Mr. Rundlett, who will retire at the end of his term, on March 14, was first appointed city engineer in 1882. He has held the position continuously since that time, with the exception of two terms of three years each.

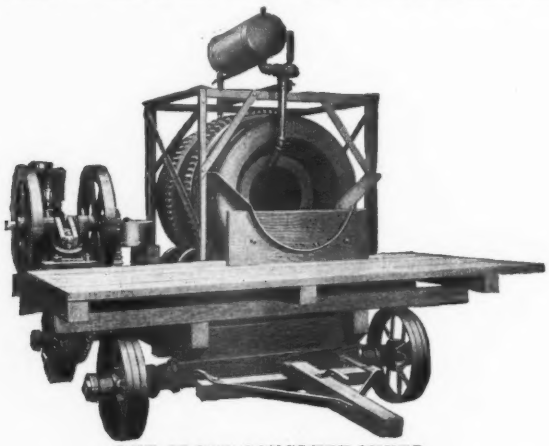
MACHINERY AND TRADE

The Cropp Mixer.

The "Cropp" Concrete Machinery Company, 84 La Salle street, Chicago, Ill., have recently placed on the market an improved double-chamber, low-charging concrete mixer. The new machine has eliminated entirely the use of high scaffolding and charging hopper. The material is charged at a low point and discharged at a much higher point, and will handle material as fast as it can be supplied to it.

These results are obtained by placing within the drum two separate and distinct chambers. The first of these is known as the receiving and mixing chamber. A wheelbarrow of sand is dumped into the receiving chamber, and two wheelbarrows of stone and one sack of cement, and the water is applied early when the first barrow is dumped; then when the last wheelbarrow is being dumped the door in the transfer passage way between the two chambers is thrown open and the entire contents of the receiving chamber are transferred into the storage chamber. The receiving chamber is then ready for another batch, and the contents of the storage chamber can be discharged at will. The operation is then repeated. Thus there is no loss of time, for as soon as a man can dump his wheelbarrow and get away, the next man behind him can dump his barrow, and the performance can be repeated as fast as the wheelbarrows can be dumped. There is no waiting involved as in the case where the charging hopper has to be dumped before the next barrow can be emptied.

In addition to these features of time-saving value, the material is being constantly mixed until discharged, and the fact that it travels through two chambers assures that the mixing will be thoroughly accomplished. The accompanying photograph shows one of the machines complete with a gasoline engine, and the charging platform rigidly attached to the trucks at the charging end.



THE CROPP CONCRETE MIXER.

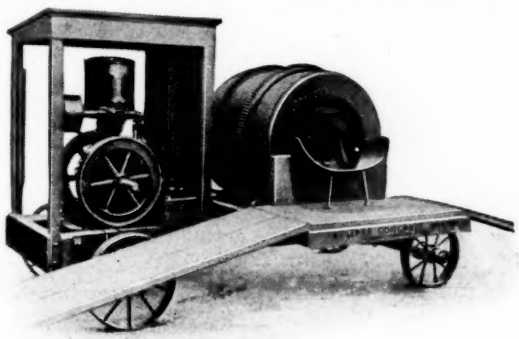
The Kuhlman Patent Sewer Cleaning Machine.

There has been in use for a number of years, though only recently was it patented, a sewer-cleaning device which has been used with marked success in the cities of Chicago, Ill., Indiana Harbor, Hammond and Gary, Ind., Watertown, Oconomowoc and Wausau, Wis. This machine, known as the Kuhlman patent sewer-cleaning machine, is manufactured by the Northern Manufacturing Co., of Hammond, Ind.

The machine complete consists of 5 clam-shell buckets, 2 cables, one small and one large windlass, and one trolley system. The operation of the device is very simple and efficient, and is essentially as follows: The windlasses are set at manholes, some distance apart, a line being passed from one to the other. The bucket is then placed at the end where the smaller windlass is located, and is drawn through the sewer, its peculiar construction allowing all liquid matter to filter through and collecting only the solids, dirt, roots, sand, brick, cinders and all other foreign mat-

ter. Upon arriving at the second manhole the trolley arrangement engages, swinging the bucket with its collection of material free and allowing it to be raised to the surface without disengaging it from the cable by means of which it was drawn through the pipe. In this manner absolutely no handling by hand is required. The operation is repeated on the return trip of the bucket.

The advantages of the machine lie in the fact that it does not interrupt the flow of the sewer while in operation; it will remove all gravel, brick, stone, sand and other refuse; it may be used with economy in any size of sewer, from 10 inches to 10 feet; and in the direct application of the power which draws the cable in raising the material to the surface. Cases are on record in which the machine has successfully removed obstructions such as toughened roots, large stones, and even in one case in Wausau, Wis., an almost solid obstruction of sand with which was mixed sufficient tar to make the mass compact. In the latter case about 1,700 feet of sewer were cleaned at a saving of about $1,800.



THE ECLIPSE CONCRETE MIXER.

The Eclipse Concrete Mixer.

The Eclipse Concrete Mixer, as illustrated herewith, is a machine adapted for various classes of work. A special feature of this machine is the low-charging drum, which makes it necessary for the charging platform to be only about 24 inches high when the mixer is mounted on truck and high enough to discharge into wheelbarrows at the discharging side. This charging platform is mounted on the truck with the mixer and is always complete, ready for operation as soon as it arrives on the job.

The large opening in the charging end of the drum is another advantage, because the entire batch can be seen while mixing, and it can be determined before discharging that the concrete is in the condition desired, and it is not necessary to discharge part of the batch to see whether it is too dry or too wet, as often happens with mixers with small openings. The fact that the entire batch can be seen while mixing enables the contractor to produce uniform high-grade concrete and avoids any loss or damage which is liable to happen if the concrete is not uniformly mixed.

The discharging arrangement on the mixer is semi-automatic in that the discharge door is held in either mixing or discharging position by a strong spring under tension, and all that is necessary for the operator to do is to throw this door past the center of tension in either direction and the spring will complete the movement and hold the door until it is again thrown open by the operator. This door can be thrown open for discharge and left open until the entire batch is discharged, or, as the mixer is made to discharge about 3 cubic feet or one wheelbarrow of concrete per revolution, the door can be closed after a barrow of concrete is discharged and left closed until the next man has placed a wheelbarrow in position.

The blades within the drum are set diagonally and made to overlap, so that when the material is fed to the blades over the charging chute it passes into the interior mixing portions of the drum as the blades advance, and, of course, can not return again as long as the drum is kept revolving. For discharging there is a low blade extending across the drum leading to the discharge pockets. This blade carries over the balance of the material to the pockets when the drum is nearly empty, but is low enough so that the greater part of the material falls over when the drum is full. The pocket at the discharging end is closed by throwing the discharge door so that the concrete entering this pocket is lifted and discharged from the discharge chute.

It is not necessary to have a man operate the discharge door, as the one wheeling can throw the lever without any difficulty.

From this description the contractor will readily see that the mixer is very simple to operate. The men are only required to wheel the material on the low platform, about 24 inches high, and on account of this platform being so low they can run a barrow up a 12-foot plank almost as easily as on the ground. The material from the barrow can be thrown into the drum very quickly on account of the large opening. In discharging the drum it is preferable to put in a barrow of stone or gravel first, to be followed with a barrow of sand; the cement can be placed on top of the sand in the barrow and both be dumped in together, then another barrow of stone following the sand and cement, the water having been placed in the mixer first. This method, of course, is based on the one-bag charge, and by charging the mixer in this manner it is only necessary to allow two or three revolutions of the drum after the last barrow is thrown in before the batch is ready for discharging, due to the fact that the materials are being mixed during the process of charging, and it is only necessary to thoroughly mingle the last barrow with the balance of the material.

When the work is rushed and the concrete wheelers have become accustomed they can discharge the drum without closing the discharge door after first opening it. To do this it will be necessary for them to have enough of barrows ready so that when the door is opened and the first barrow loaded from the first discharge revolution of the drum, the first wheeler will pull his barrow back from under the discharge chute and the second wheeler push in a barrow from the other side, catching the discharge from a second revolution, when he will pull his barrow back and the third man come in from the same side as the first man and take the discharge from the third revolution.

It will be seen from this description that if three revolutions are figured for mixing and four for discharging and the drum operated at 14 r. p. m. there will still be seven revolutions allowed for discharging, which should be done in three or four revolutions, or as quickly as the discharging, and by making one batch per minute there would be allowed about three revolutions for lost time.

While the machine as described would be the ordinary outfit mounted on truck, the Eclipse is built in various styles, capacities and is mounted to suit special conditions, also furnished with hoist for handling the mixed concrete when desired. The mixers are also furnished with either gasoline, steam or electric power, the one shown in the first illustration being gasoline driven.

One other feature about the Eclipse Mixer is that it will operate on either wet or dry mixed and with any kind of material. It can also be used for mixing cement mortar or top dressing for sidewalks, the smaller sizes being especially adopted for sidewalk work.

A recent addition to the machine is a flexible means of discharging the concrete after mixing, which allows the material to be placed exactly where desired and distributed over an area equal to the half circle of which the discharge arm is the radius.

The Eclipse Mixer is manufactured by the Standard Scale and Supply Company, 1345 Wabash avenue, Chicago, Ill, and is described in their catalogue No. 35.

The Burr Municipal Castings.

The E. M. Burr Co. Foundry at Champaign, Ill., has for a number of years made a specialty of municipal castings of all sorts, and have established a reputation for prompt service and excellence of workmanship in such supplies.

Catalogue No. 12 of this company shows a complete line of castings manufactured by them and contains a great deal of information which is of value to city engineers and contractors engaged in municipal work. Among some of the supplies listed are catch-basin rings, lamphole covers, manhole rings and covers, curb inlets of every conceivable type, catch-basin inlets, gutter plates and tampers.

In addition to these municipal supplies, the Burr Company has a patented gasoline and distillate vertical hoist. This hoist is of the standard vertical type, connected by gears to a hoist drum, the whole mounted on a bedplate. The construction is such that it can be taken apart, no one part weighing over 250 pounds.

The pinion on the engine shaft is provided with a dental clutch, so designed as to disconnect the engine from the hoist drum when desired. This makes the engine available for general purposes, such as pumping, running dynamoes and for running concrete mixers.

In addition to the above-mentioned machines and supplies, the Burr Company manufactures a number of special castings and is equipped to handle special work with an assurance of satisfaction and promptness.

The Cannelton Sewer Pipe Company.

In connection with coal mining operations at Cannelton, Ind., previous to 1850, deposits of a superior quality of clay for stoneware manufacture were discovered. In the early fifties the Clark Brothers of Ohio, attracted by this deposit, built a small plant, which was the nucleus of the present Cannelton Sewer Pipe Company. This small plant continued in the manufacture of sewer pipe and other stoneware for about 45 years, when for various reasons the plant was taken over for the exclusive manufacture of stoneware.

By reason of the splendid quality of the product, several local parties with a thor-

ough faith in the properties of the clay for sewer pipe organized and capitalized the present company. This company, the officers of which are John Meyer, of New Albany, Ind., president; Henry Bosquet, of Louisville, Ky., vice president; A. P. Clemens, of Cannelton, Ind., treasurer, and H. P. Clemens, Cannelton, secretary and general manager, completed and put in operation in 1909 the present very complete sewer pipe plant.

This plant consists of a main dry room, built of brick, three stories in height; a four-story machine room and a boiler and engine room. Twelve kilns, 30 feet in diameter, of the down-draft type provide for the fireing. In the dry room there is a floor space of 46,000 square feet; the steam dryer system being used exclusively, the ample space allowing of the continuous operation of 12 kilns.

The power plant is equipped with two 150-horsepower boilers, one Brownell 225-horsepower engine, one press, one dry pan, two wet pans (all of the Stevenson make), one Grote power elevator, and one Taplin-Rice gravity elevator.

The plant has operated continuously since its completion with the exception of three weeks, begining January 1, 1911, when it was necessary to shut down to put in additional machinery. The product includes salt-glazed sewer pipe, wall coping, stove pipe and flue liners. Sewer pipe is made in sizes varying from 3 to 24, both in the standard and double strength, and fire clay is used exclusively in their manufacture. The normal capacity of the plant is 100 car loads per month.

The shipping facilities are very complete, the yards being equipped with two switches, accommodating 19 cars, and conveniently located for the rapid handling of the product. The accompanying illustration shows the method of river transportation in low-water season, the barge shown being loaded with eight cars of 15-inch pipe, consigned to Hartford, Ky. The product is marketed in Cincinnati, Indianapolis, Louisville, Evansville, Nashville, Memphis and New Orleans, and in the States of Oklahoma, Arkansas, Montana, South Dakota, Texas, and Old Mexico. The entire shipments for the first year was over 800 cars.

The quality of the pipe furnished by the company has been tested by one of the most exacting sewer commissions, namely that of Louisville, Ky. In connection with the construction of the $4,000,000 sewer system in that city certain specifications were insisted upon, and tests made under the personal direction of the inspector of materials. The results of these tests are given herewith.

SHIPMENT OF CANNELTON SEWER PIPE ON THE OHIO RIVER.

The first pipe tested was made by Cannelton Sewer Pipe Company, Cannelton, Ind. Fire clay pipe, brownish yellow in shade, ¼ of the socket being broken off and was selected by the inspector on Frankfort avenue sewer. This pipe broke under a pressure of 7,355 pounds.

Four other tests were then made, using the product of two other companies. The test piece in each case being the 15-inch double strength, 24 inches long. These broke at pressure of 5,270, 4,870, 4,500 and 3,655 pounds respectively. A second

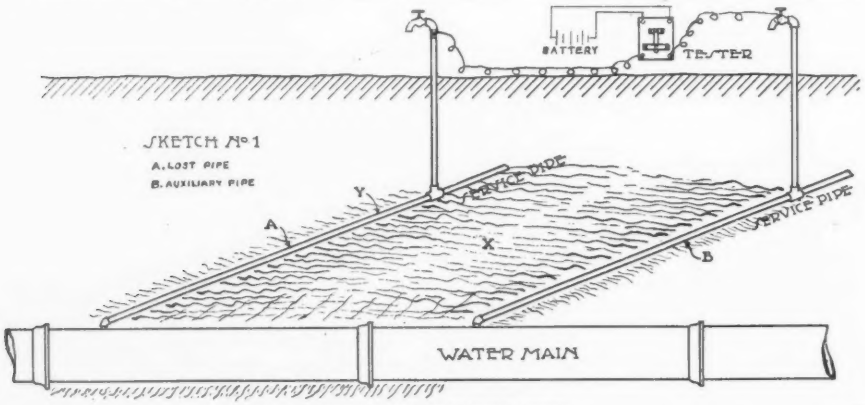
test of the Cannelton Sewer Pipe Company's product was then made, breaking this time under a pressure of 5,470 pounds.

The reason for the exceptional strength of the Cannelton product is the fact that the clay of which it is composed possesses qualities practically ideal in proper constituents. Combined with this is the fact that the long experience, over fifty years, in manufacturing stoneware products, has reduced the proper combination of material and the proper firing to a scientific basis, practical, efficient and having nothing of the nature of experimentation at the expense of the user.

The main offices of the company are located at Cannelton, Ind., and the territory west of the Missippi river is taken care of by the St. Louis Clay Products Company.

The D. B. M. Wireless Pipe Locater.

The Modern Iron Works, of Quincy, Ill., is manufacturing an apparatus for use in locating pipes under ground. To anywho has had to dig numerous test holes or to make "soundings" by means of a long iron rod, the value of the instrument will be at once apparent.



WIRELESS PIPE LOCATOR.

The diagram given herewith serves to illlustrate the working principles of the apparatus. An instrument for producing an electric current is attached as is shown, being marked "tester" in the diagram. This instrument is self-contained and compact within itself. The "locator" is then carried by the operator, no wires nor superfluous parts being attached to the small box within which the "locator" is contained. A special head telephone receiver is provided, attached to the locator, which is merely to all appearances a coil of wire about 6 inches in diameter. Through the telephone receiver, the operator can hear a distinct tone, which changes to a marked degree upon coming directly over the buried pipes. In this way the location of the hidden pipe can be followed as far as may be necessary.

The entire apparatus is mounted in a nicely finished case, equipped with a lock and handle for carrying. The principle of the locator is not magnetic, being based entirely upon the theory of wireless wave transmission. Fuller description of the instrument will be furnished upon application to the manufacturers, the Modern Iron Works, 500 Ohio street, Quincy, Ill.

Economy of Marriott Curb Conduit.

Mr. J. C. Marriott, Park Row Building, New York City, presented the following very interesting argument at the office of the president of the Borough of Manhattan, New York City, regarding the economy of the use of his curb conduit for the removal of snow by water carriage:

On a 90-foot street (building line to building line) with average annual snowfall of 26 inches (or 2 1-3 feet), we have 2 1-3 times ninety or 210 cubic feet of newly-fallen snow. After trampling, shoveling and packing, this is reduced to four-tenths in its original volume, or 84 cubic feet, which equals 3 1-8 cubic yards. At 43 cents per cubic yard for haulage, this is slightly in excess of $1.33 as the annual snow-haulage cost per linear foot of street. Multiplying $1.33 by 5,280 gives $7,022.40 per annum.

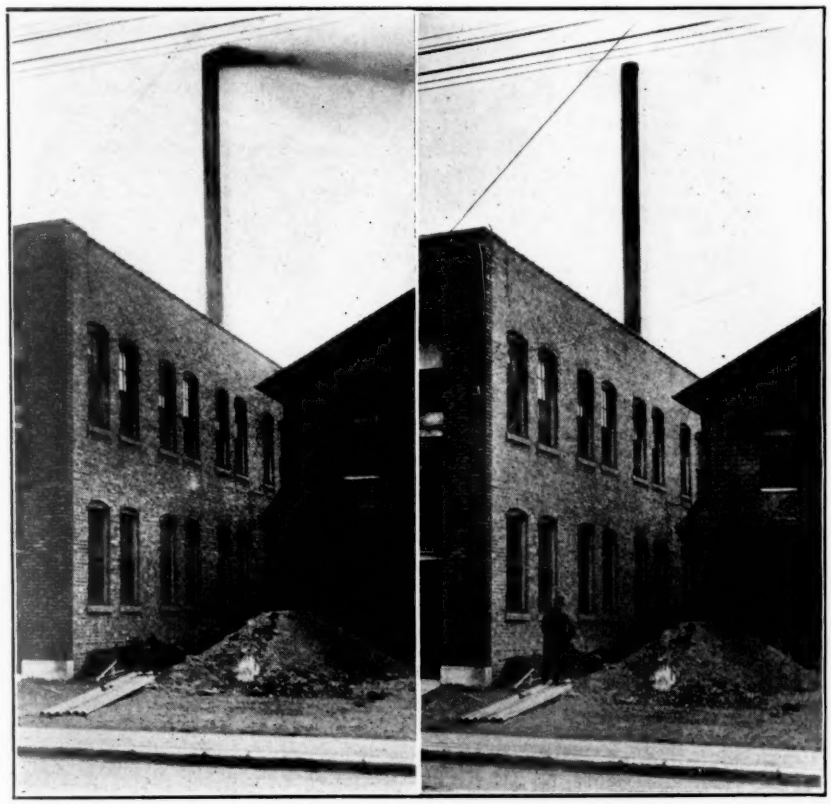
The cost of blue-stone curbing at $1 per linear foot (omitting width of cross streets) is $4,000 for each side of the street, or $8,000 per mile, and such installation cost provides a dividing line between the sidewalk and roadway surfaces, and thereafter necessitates the above-mentioned annual outlay for snow haulage of $7,000. The cost per mile of curb conduit at $1.75 per linear foot is $7,000 for each side, or $14,000 for installation cost, and ever thereafter effects a saving of $7,000 annual snow-haulage charge. Two years' snow-baulage saving installs the curb-conduit—omitting consideration of the $8,000 initial cost of bluestone curbing, and also omitting considera-

tion of the value of the curb-conduit during at least 300 additional days each year, as an efficient means for surface-drainage of rainfalls and of the street scourings incident to the use of sprinkling and flushing carts for cleaning streets.

The Royal Laundry Smoke Prevention.

The city of Indianapolis has recently been agitating the question of smoke prevention, with the result that a number of manufacturers were brought to the consideration of smoke preventive devices. The Royal Laundry Company, by reason of its situation directly opposite the Masonic Temple, a white stone structure, was one of the offenders first to be noticed. It may be said to the credit of the company that the smoke inspector was not obliged to take any action to compel them to accede to the provisions, but the company of its own volition installed a furnace which has been highly satisfactory to all concerned.

This furnace was installed under the 100-horsepower return tubular boiler which was already in use in the laundry. The principle of the device involves the complete combustion of the fuel in the firebox. Two air ducts are provided which carry the air from the interior of the ash pit, at the side, across the front of the firebox above the arch of the door. Directly above the door are placed two "dissociators," one being connected to each of the air ducts. Connected to each of these "dissociators" are pipes carrying steam under pressure. This steam is blown through the "dissociators" into the firebox, dissociating the steam into its constituents and directing them into the products of combustion arising from the burning fuel on the grate. This results in a complete combustion of the latter, entirely eliminating all smoke.



With Smokeless Furnace Inoperative. With Smokeless Furnace in Use.

THE ROYAL LAUNDRY, INDIANAPOLIS.

In the case of the Royal Laundry installation, the two photographs will indicate the thorough results of the use of the apparatus. In the first picture the steam was shut off, eliminating the smokeless appliance entirely from use. The fire was about ten inches thick on the grate,

and was freshly replenished with a mixture of Indiana straight run and slack (sometimes called "Indiana real estate"). The volume of smoke may be noted. The steam was then turned on, and within 16 seconds, the time it took the gases to travel through the firebox and up the stack, the result was as is shown in the second photograph.

The device used may be adapted to any boiler; in fact, this installation was made in 36 hours' time, during Saturday night and Sunday, without interfering with the operation of the plant. The Harris Smokeless Furnace, as it is designated, is manufactured by the Harris Smokeless Furnace Company, of Nashville, Tenn.

Sewage Ejectors.

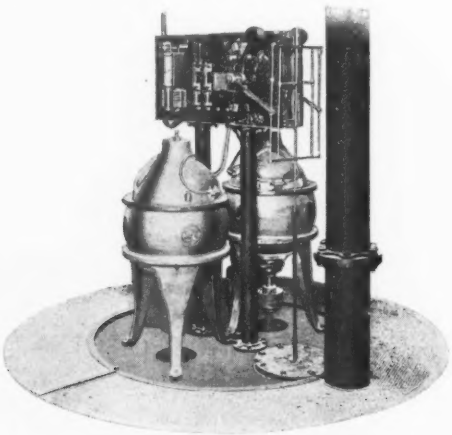
The application of centrfugal pumps to the more exacting pumping operations has widened the field of this type of pump in the last few years. Among other important applications that of sewage pumping, even in small plants such as required by city buildings where the sewer is too high to drain by gravity, has been made a matter of special study by Yeomans Brothers, Chicago, who have developed a centrifugal sewage ejector which has been thoroughly worked out by ten years' experience. These ejectors are large enough to take care of municipal work and many are now in service.

As compared with the old, pneumatic method of sewage ejection, these centrifugal ejectors take one-fifth the space, and less than one-fifth the power to operate, and cost much less in addition. They can be operated by electricity, steam, gas or gasoline, and are not subject to clogging or any kind of sewage, and are entirely automatic and noiselelss in operation. For use in connection with sewage purification paints, they are indispensable where pumping is required.

Among the distinctive features of the Yeomans ejector, the following are of especial interest to engineers and architects:

1. The ejector is ordinarily constructed with two complete units, and the automatic control is so arranged that if one unit should fail or prove inadequate in case of flood conditions the other machine acts automatically.
2. The ejector is further equipped with an automatic high-motor alarm bell, which instantly informs the attendant of failure of the machine to operate.
3. The Yeomans ejector is so arranged that it will pump out its own pit in case the latter should become flooded.

These invaluable characteristice, combined with low first cost and power consumption and saving in floor space, make this ejector a desirable machine from both engineering and commercial points of view.



YEOMAN'S DUPLEX EJECTOR.

The Yeomans ejector is in use in the Cook County Court House, City Hall, central and sub-stations of the Commonwealth Engine Company, and in many of the modern public buildings in Chicago, as well as in New York, Boston, San Francisco, St. Louis, Pittsburg, New Orleans, Spokane and other cities.

Full information regarding the ejector and its operation may be obtained by addressing Yeomans Brothers, Monadnock Building, Chicago, Ill., and inquiring for catalogue "D."

The King Junior Road Grader.

The essential elements of road construction demand thot there shall be liberal side ditches provided for drainage, for regardless of the kind of road, its maintenance and its durability are most directly dependent upon the one factor—drainage.

This fact has made it necessary in most instances for the road builder to

have in his equiment, in addition to the graders and other machinery, a plow or other more or less efficient means of providing for the side ditch. With the development of the road grader, manufactured by J. D. Adams & Co., Indianapolis, this plow has been displaced and its work better accomplished.

This grader, known as the King Junior, has details of construction which make it a most practical road-building machine. The wheels are so set as to be adjusted to lean in the direction towards which it is desired to move the dirt. This is not, as some have imagined, made necessary by reason of the inclined face upon which the machine works; but it is so provided that the weight of the machine is made to counteract the side thrust of

KING JUNIOR ROAD GRADER.

the dirt and allow the latter to be moved up hill. This renders it entirely free from side draft, lightening the back pull of the machine upon the teams. By reason of this fact it is possible to average from one-half to two times as much work with the same teams in a given time as would be possible without the leaning wheels.

The photograph shows the machine in actual work with four horses. The material is being moved up toward the center of the road to make the grade. The sharp angle of the mould, which assures a light draft, will be noted, and the feature of the leaning wheels is here shown, the machine being held firmly against its load without slipping.

The machine is of extra strength, weighs about 2,300 pounds, and has a mould 7 feet in length. It is equipped complete with double and single trees, evener, pull chain and extra cutting edge.

An Improved Material for Pipe Jointing.

Advances had been made in every feature of cast-iron construction, including the perfecting of the form of bell and spigot pipe; the increased accuracy of molding; improved caulking tools and a a number of other changes which had developed under years of use; but until recently there has been discovered no means of providing a tight joint without using the antiquated lead caulking, which is and has been one of the greatest stumbling block in water main work.

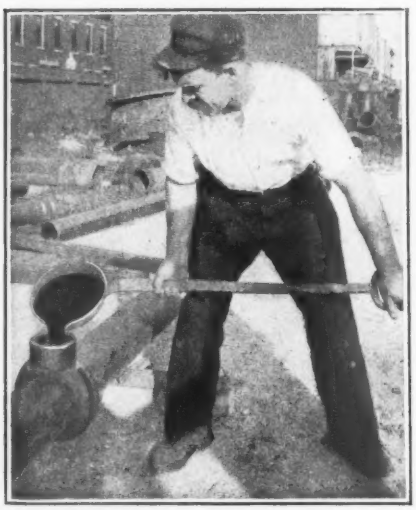
A new material was used for the first time some years ago, which material under the most rigorous usage and tests has proven superior to the lead joint. This material, known as "Leadite," is a substitute for lead, composed of mineral ingredients, but differing from the former in a number of very important features.

The "Leadite," which in its commercial form is a powder packed in sacks or barrels, weighs only 118 pounds per cubic foot; and from its nature will make four times as many joints as an amount of lead of equal weight. It makes a joint which is permanent and water-tight, and will not leak under any pressure used in water works service, its strength and adhesion to the joint increasing with age.

A number of severe tests have been made of the properties of the "Leadite" joints, among which were the following:

A line of pipe 85 feet long was sup-

ported on blocks at both ends and allowed to sink to the ground at the center, a pressure of 100 pounds being maintained without the slightest evidence of leakage. Test pieces of extra heavy 6-inch pipes, 5 feet long, were allowed to drop 8 feet upon a log, and afterwards sustained a pressure of 130 pounds without leakage. Two lines of pipe 98 feet in length, one jointed with lead, and the other with "Leadite," were allowed to freeze over night, with the result that the first sample was parted in the middle, while the second remained intact. Other tests have proven "Leadite" to be proof against oxidation and electrolysis; and pipes which have been removed after 15 years' service have been found free from leaks, proving its durability. Th Leadite Company, 1236 Land Title Building, Philadelphia, who



POURING A PIPE JOINT
WITH LEADITE.

are the manufacturers of "Leadite," have received a large number of letters which further assert the practical lasting qualities of the joints.

The method of making the joints with this material eliminates one of the greatest expense items of cast-iron main construstuction. For, in addition to the fact that the tedious hand-caulking is done away with, there is a considerable saving in the cost of bell holes, which are unnecsary in making "Leadite" joints. The accompanying photograph illustrates the making of such a joint. The compound is melted in the ordinary gasoline furnace, and is poured into the joint after the latter has been yarned in the ordinary manner. The compound, upon cooling, grips the cast iron, forming a watertight joint, whic h the afore-mentioned tests show to possess every feature of perfection.

The Favorite Wood for Street Paving.

As a result of a number of inquiry circulars sent out to the leading cities of the United States, the American Society of Municipal Improvements has collected an interesting set of data regarding the use of wood in street paving. One of the questions upon these blanks was: "What is your favorite wood for wood paving blocks?" There were thirty replies received in answer to this question, each reply being specific in its meaning and unqualified as to any consideration which would admit of any doubt as to the assurance of the choice indicated.

Of this total of thirty replies there were twenty-three cities which endorsed yellow pine. Some cities had stated their preference for long leaf, and a smaller number preferred the short leaf. With the enormous amount of wood block pavement in use at the present time in these larger cities the answer to this question may be taken as accurately indicating the pavement which has given the best satisfaction.

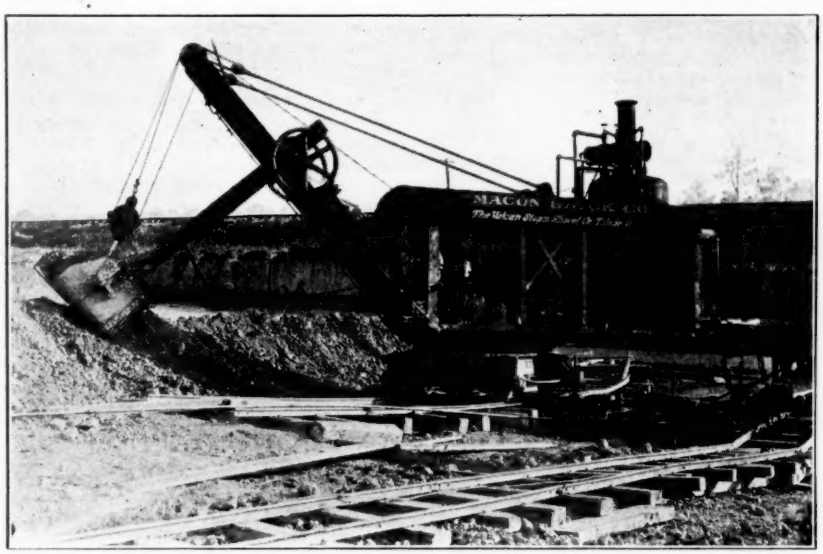
The good qualities of the wood block pavement are now acknowledged, though for a number of years there was considerable doubt relative to its durability. As regards this property, there are pavements in Boston which after five years of the heaviest of traffic have shown a wear of only about $\frac{3}{8}$ of an inch. Another pavement, in Chicago, has shown only $\frac{1}{8}$ inch of wear under heavy traffic and has been in constant service for nine years. In both of these cases the wear was even over the entire surface, so that the pavement was in no way roughened.

Another feature upon which some doubt has been stated is with regard to the slipperiness of the surface of wood block pavement. This matter was another of the points upon which the American Society of Municipal Improvements asked for information. Twelve of those replying to the above question stated that they did not find the slipperiness objectionable, one stated that wood was no more slippery than asphalt, and another that wood was by no means as slippery as asphalt. In reply to this question there was more discussion submitted than in the previous case. The majority of those who did state that wood blocks were slippery qualified their statement by the fact that this quality could be largely prevented by keeping the pavement clean and dry and in such condition as all pavements should be maintained. In those cities which stated that the wood pavements were slippery, sand was recommended as a remedy, while one city uses ashes and another cinders.

The statement is sometimes made that wood is impracticable for use on streets with a grade greater than 2 per cent. In reply to a question along this line it was found that eighteen of the larger cities have wood block pavements upon grades greater than 2 per cent. Of these there were eleven who had laid the wood upon

grades of 3 per cent or more, and one city, Hoboken, N. J., reported no trouble with a 4½ per cent. grade. These figures prove conclusively that the old statement is one of those old ideas which have been so obstinately held and which have forced the most rigorous of tests before dying out. The increasing use of the wood pavement under these conditions is in itself sufficient evidence of its superior qualities.

The Yellow Pine Manufacturers' Association, seventh floor Wright Building, St. Louis, Mo., have for distribution a number of valuable booklets which recount the reports and the results of tests upon yellow pine paving blocks, and in addition contain information regarding the best practice in laying and maintaining the pavement.



VULCAN STEAM SHOVEL IN BRICK CLAY PIT.

A Revolving Steam Shovel in a Brick Plant.

In properly equipping a small or modern brick plant to insure economy in operation there are many things to be considered, and while the broad economics of the steam-shovel plant are well known to a large number of brick manufacturers, yet there are many who are prone to take into consideration the first cost only, and the question that often arises is whether the capacity of the plant will warrant the installation of a steam shovel.

It has been demonstrated many times that a plant having a capacity of from 30,000 to 60,000 brick per day can be operated much more advantageously and economically by utilizing a small-sized steam shovel for handling the material than by the old method of hand labor. The difficulty in procuring efficient labor, especially during the busy season, and the many delays incidental thereto has always been a more or less serious problem for the brick manufacturers to solve and one that has usually been successfully solved by the installation of a steam shovel.

A very good example of the low cost at which a steam shovel plant may be operated may be seen in the plant of the Macon Brick Company, which is operating a 25-ton revolving shovel in its plant at Macon, Ga. This company manufactures from 50,000 to 60,000 building and press brick per day, which requires only about 100 cubic yards of material, therefore the shovel is used much less than half the time.

The material is a very fine quality of brick clay which is loaded by the shovel into two 2-yard clay cars. A cable is then attached to the loaded cars and they are hauled to a large Chambers granulator, the length of haul being about 800 feet. The material is then dumped into the granulator from which it is taken direct to the brick machine.

The company manufactures a very fine grade of brick, and their limited output has kept them behind with orders about eleven months in the year.

The shovel is a Vulcan 25-ton revolving type and carries a ¾ cubic yard dipper. The dipper handle is 12 feet long and the dipper will dump 10 feet 6 inches above rail. It will clear a floor 32 feet wide and make a cut 40 feet wide in a 6-foot bank. It swings through a complete circle, which enables it to dig and dump on all sides and at rear.

While it usually requires about one man to operate this type of shovel for moderate outputs, the Macon Brick Co., however, have two men on their shovel, which is operated at full capacity for a

short part of the day only, or until a sufficient amount of clay has been excavated to supply their plant for the day, after which the shovel is shut down. They also employ two pitmen; and the maximum cost of operating their shovel plant per half day is about as follows:

	One-half Day.
One engineer at $5.00 per day	$2.50
One fireman at $2.50 per day	1.25
Two pitmen at $1.75 each, $3.50 per day	1.75
Oil, waste and repairs, $1.00 per day	.50
Depreciation of plant, $1.35 per day	.68
600 lbs. of coal	1.05
Interest on investment	.85
Total	$8.58

or about 8½ cents per cubic yard.

These figures are only approximate and are taken at a maximum cost and based on a half day's operation, while the shovel is really operated but a part of this time. Yet a decided saving is shown over hand labor, for to dig and load the same amount of material by hand labor would require about ten men a full day at a cost of about $17.50, or 17½ cents per cubic yard. Besides reducing the cost of excavating the material, the shovel will cut through the entire bank, thoroughly mixing the clay and resulting in a better grade of brick.

This type of shovel is also used for all classes of general contract work, road building, sewer trench digging, etc..

The Reliance Steel Stone Crusher.

The Universal Road Machine Co., 1 Emrick st., Kingston, N. Y., is manufacturing a steel stone crusher, which is one of the most simple as well as one of the most powerful machines on the market. The frame and all the working parts of this crusher are of solid castings of open hearth steel, thoroughly annealed, while forgings and shafts are of the best quality open hearth hammered steel of special carbon content, ensuring great strength and durability. The jaw plates are of manganese steel, the toughest and most durable of known metals, the jaw plates and check plates being reversible.

The crusher can be quickly and easily adjusted to vary the size of the product. Each machine has four adjusting plates, which in connection with two adjusting liners give twelve different sizes of product, varying each about 3/16 of an inch. This does away with the annoyance of ordering intermediate or special sized adjusting plates in order to obtain the full output of the machine. The Reliance crusher does not require the disconnection of the tension rods in order to change the adjusting plates. By backing off the nuts and bearing down on one side rod the adjusting plate may be readily removed by means of a large eyebolt furnished for that purpose. This is a great saving in time and trouble over old methods. All the bearings in the machine are protected, and there are no gears to wear out, and every part that is exposed to wear is easily accessible and can be readily removed and replaced.

Another feature of the crusher is the fact that it is built low to the ground, which greatly reduces the labor of feeding. The swinging jaw plate is designed to obviate the danger of stone becoming clogged upon entering the jaws of the crusher.

The Universal Road Machine Co. also manufacturers a number of machines which will recommend themselves to the users of crushers who require plants capable of easy and quick transfer from place to place. These machines, the Reliance steel truck, the Reliance folding elevator and the Reliance portable bin, combined with the crusher above described constitute a complete plant which may be easily and quickly moved and set, which handles the product easily and is convenient and efficient in operation.

The Merriman One Car Asphalt Plant.

The One Car Asphalt Plant, manufactured by the East Iron Machine Company of Lima, O., has given great satisfaction for a number of years. This plant is, as its name implies, entirely contained on one car, and yet has a capacity of 1,800 square yards of 2-inch sheet asphalt, or 400 yards of 1-inch binder in ten hours.

It is made strong, to withstand the hard usage incident to the asphalt business. All the machinery parts are direct connected, eliminating all belts for transmission. The asphalt pipes and valves are all steam-jacketed, which precludes the possibility of freezing in cold weather, and the tanks are piped for either air or steam agitation.

The asphalt is heated with steam furnished from a 125-horsepower flue Marine-type boiler, the use of steam eliminating all possibility of burning the asphalt. The two independent tanks have a melting capacity of 712 cubic feet each, each tank being equipped with four coils of 1¼-inch double-strength pipe, electrically welded, leaving no connections within the tank, where leaks may occur. The condensed steam from the tanks returns to the boiler by means of a hot-water pump working automatically.

The sand drum is 28 feet long, 5 feet 6 inches in diameter, has four heavy spiders on inside and 8-inch shaft. This is a return heat drum, the heat passing under and returning through same. Flights are inserted on the inside for conveying sand and stone through. It is a strong, substantial drum and has a capacity in excess of requirements and is very economical from a fuel standpoint, owing to its large heating surface.

The hot-sand tank, screen, mixer and a mixer engine, hoisting engine and elevator engine are all on a sliding carriage on one end of the plant, which is slid out in position to drive under by means of

two large screws. The hot-sand tank is raised and lowered by four right and left-hand screws, one on each corner—raised when in operation and lowered when being transported. This saves removing tank from car when being transported.

One of the plants in actual use laid 114,000 square yords of finished material, traveling 1,185 miles, being taken down and set up seven times and lost about four weeks waiting on material. The same plant laid 162,000 square yards and traveled 1,260 miles in one season. The plant being self-contained involves very little outlay in taking it down and setting it.

G. F. W. Road-Oiling Machinery Business Changes Hands.

Many of the roads of the present are constructed with a binder of asphalt oil or similar material. The pressing need at this time is for machinery capable of handling this material in the quickest, easiest and most economical manner. Realizing this fact the Good Roads Machinery Company, Kennett Square, Pa., who are specialists in road-building machinery, tools and supplies, have taken over the road-oiling machinery and devices hertofore manufactured by the G. F. W. Co., Saratoga Springs, N. Y. This machinery will hereafter be manufactured at Groton, N. Y., and will be marketed by the Good Roads Machinery Company through its various branch offices and selling agencies.

The Perfection Oil and Asphalt Distributor has been manufactured and sold by the G. F. W. Co., Saratoga Springs, N. Y., for the past two years, and has received the endorsement of road-building contractors as well as of highway engineeers in New York and other States. With this machine it is possible to heat heavy oil and spread it upon the road in a smooth, unbroken sheet in any volume required. The appliance also handles lighter oil that does not require heating. That the machine is a labor and money saver is evidenced by the fact that it can be operated by one team of horses and one man. The fuel cost per day does not exceed $1.00.

For further information in regard to the Perfection Oil Distributor and other oiling devices address The Good Roads Michinery Company, Kennett Square, Pa.

A New Reisert Water Filtration Plant.

The Anheuser-Busch Brewing Association of St. Louis is at present engaged in remodeling their filtration system at their lower ice plant. They have awarded a contract to the Reisert Automatic Water Purifying Company for the installation of three gravity filtrers of the New Improved Reisert type, which will have a total capacity of 4,000,000 gallons per days. These Reisert filters will replace filters of another make, the operation of which will be discontinued and will be installed in the existing filter house.

The water to be filtered is pumped from the Mississippi river into two settling tanks of 500,000 gallons capacity each, in which the water is treated with caustic lime and sulphate of alumina. From these settling tanks the water flows into a large reservoir holding approximately 1,500,000 gallons, and from this reservoir it overflows to the Reisert filters.

Each of the three filter units is 35 feet long by 15 feet 2 inches wide, and is 11 feet high. The capacity of each unit is 60,000 gallons per hour. As they were necessarily designed to fit the present filter house, they are constructed wholly of tank steel, to save space. The filtering material is selected filtering gravel and fine crushed flint.

The filter beds are washed, according to the Reisert method, with filtered water and compressed air. The ratio of the wash water required to the total amount of clean water delivered by the filters is 1 to 60.

For cleaning purposes one unit at a time is shut off, and the cleaning does not occupy more than from one to two minutes each time. In this manner the capacity of the plant is maintained practically uniform. Each filter unit will be cleaned on an average of twice in 24 hours.

The first unit will be in operation on or before March 15th, and the entire plant before April 15th. The water will be used for beer and ice-making and boiler purposes.

The Busch-Sulzer Brothers-Diesel Engine Company.

On January 26th was incorporated at St. Louis, Mo., one of the largest engine manufacturing companies in the United States. The company was incorporated with a capital stock of $2,100,000, and has for its purpose the manufacture of the Diesel oil engine, which has been manufactured and used in this country for some years. The officers and directors of the new company are:

Adolphus Busch, president; August A. Busch, first vice president; James R. Harris, second vice president and general manager; Edward A. Faust; E. D. Meier, president American Society Mechanical Engineers, New York; Robert Sulzer, of Gebrueder Sulzer, Winterthur, Switzerland; Eugene Angert, attorney, St. Louis; Rudolph Diesel, engineer, Munich, Germany; Daniel N. Kirby,of Nagel & Kirby, attorneys, St. Louis.

One of the first acts of the new corporation will be the erection of one of the most modern and complete plants in the world, the estimated cost of which is about one million dollars. The location of the plant has not as yet been definitely decided upon, but unless the location of the plant in St. Louis would interfere with its success, that city will no doubt

be selected. The connection of Adolphus and August A. Busch with the company will no doubt operate to influence the selection of St. Louis.

Adolphus Busch has been interested in the Diesel engine business since the Diesel engine was invented by Rudolph Diesel, an engineer of Munich, Germany, who is to be one of the directors of the new company, and even as far back as 1897, when Mr. Busch bought the basic patents for the United States of America and anada, he saw the great future of the engine, although it was then in the embryo stage, having just been invented and not a commercial article.

On May 10, 1909, Adolphus Busch bought the assets of the American Diesel Engine Company and transferred the business of the company from New York to St. Louis. It has since been managed by James R. Harris, under the close direction of August A. Busch.

The old American Diesel Engine Company brought their type of Diesel Engine to a very high state of perfection, so that the engines now being manufacturers by Adolphus Busch, purchaser of the American Diesel Engine Company, are giving the greatest satisfaction to its users throughout the United States. This is well demonstrated by the fact that the present company conducted by Mr. Busch has sold over 1,000 horsepower of the type of Diesel engine during the last sixteen months and could have sold more if the company had had the proper facilities for turning out the engines.

The Diesel engine is an internal oil combustion engine and is built both as a two-cycle and a four-cycle engine. Ordinary crude oil is used for fuel, and the method by which this fuel is used in connection with the engine is simple and different from that of other types of power. There are no boilers, neither is the fuel used as is gasoline in the automobile engine, although the operation in the latter case is somewhat similar. In the Diesel method of combustion there is no "mixture," nor is there any "spark" or other mechanical or electrical device to cause trouble. The cylinders of the engine (in which the power is developed and supplied through the pistons and rods to the driving shaft) contain nothing but air until the "compression" stroke has been completed, and until the temperature which results from this compression is more than sufficient to ignite the fuel. The fuel is atomized by air into an extremely fine spray and is introduced into the cylinder at a rate which does not permit of an explosion, but generates a steady pressure on the piston as does the steam in a steam engine, the quantity being regulated directly by the governor in proportion to the load on the engine.

The average experience of users of Diesel engines in this country shows that the fuel cost of operating an ordinary steam plant is cut down fully two-thirds where Diesel engines are used. Records kept by users of Diesel engines show that the average Diesel engine in service develops 100-horsepower for an hour's time on 6½ gallons of oil.

A further saving of great importance is the elimination of labor necessary in a steam plant for firing, cleaning and repairing steam boilers, labor necessary in a steam plant for firing, cleaning and repairing boilers and handling coal and ashes. It is to be noted, then, that the cost of this extra labor in the steam plant has been shown in several cases to be actually sufficient to pay for all the fuel consumed by an equivalent Diesel installation. Several Diesel installation in municipal lighting and power plants have proven them to be especially adapted to this use by reason of their economy of fuel in addition to the points just noted.

A kilowatt hour for one-third cent is the average daily record of every electrical plant driven by an American Diesel engine. This is based on a cost of three cents per gallon for crude or fuel oil.

An interesting economical feature of the Diesel engine is that no fuel is consumed until the engine is started and also that as soon as the engine is shut down the fuel consumption immediately ceases.

The new company has been particularly fortunate in procuring for their chief engineer, Mr. Max Rotter, the present chief engineer of the Allis-Chalmers Company, who has been given full authority to procure the most capable engineering staff to be found.

The offices of the company are at present in the South Side Bank building, St. Louis, Mo.

Commendation for Composite Pipe.

Though it has only been upon the market for a short time, the improved cement and metal pipe is meeting with a great deal of commendatory notice. Along this line J. Waldo Smith, chief engineer of the New York Water Supply, stated in a lecture delivered February 8th, before the New England Water Works Association, "that it would be of interest to the people of New England, which was the home of cement-lined pipe, to know that nothing had been discovered dduring all the years of experimenting which equalled cement for protection for steel, and, therefore, they were coating the 9-foot-in-diameter sfeel pipes with Portland cement and afterwards lining the same with Portland cement mortar."

The Composite Pipe Company, of Mansfield, Mass., has recently been incorporated to manufacture the cement-lined pipe, such as was described in the February issue of MUNICIPAL ENGINEERING.

Street Signs and Sign Posts.

The types of street signs and methods of designating streets are many and

varied, as a reference to the reports on street signs in different cities (tabulated on another page of this issue) will testify. The greatest number of these cities, however, use some one of the many types which are mounted on poles at the street corners.

An Early Criss Cross enameled sign is located in front of the Borough Hall, Staten Island. This is one of the many types of street signs manufactured by Joseph N. Early, Reade and Hudson streets, New York City. Of these a few of the types are the "Early Welsbach," which is adopted for use with the gas lamp which is common in street illumination in the outlying districts of many of the larger cities. The "Early Electric," which may be attached to the arc light poles, being made in either enameled or zinc stencils, with opal glasses, and the "Early Dead Welsbach," which can be used on electric or trolley poles on changing the lamps. A special one-piece lamp post is also manufactured by this company. This post was adopted by the city of New York in 1909.

IMPROVEMENT AND CONTRACTING NEWS

NOTE—Only the dates for letting of contracts are published in this department this month. Reference should be made to the large tables in the department of "Municipal Improvements, 1910–1911," on pages 232 to 291, for the fullest reports of contemplated work and work in progress in the municipal field which have ever been published. Information received after March 1 will be found in this department in the April number of MUNICIPAL ENGINEERING.

PAVING.

CONTRACTS TO BE LET.

Savannah, Ga.—Bids will be received Mar. 9 at 12 m. for furnishing 5,000 cu. yds. of cement, gravel, or similar material for public roads. Co. com.

Brazil, Ind.—Bids will be received Mar. 11, 1:30 p. m., for constructing two gravel roads. F. A. Staggs, audt.

Brownstown, Ind.—Bids will be received Mar, 6, 1:30 p. m., for constructing a gravel road in Vernon tp. H. W. Wacker, audt.

Lebanon, Ind.—Bids will be received Mar. 13, 7:30 p. m., for graveling and constructing sewer in Baronne st. Edmund Connor, cy. clk.

Muncie, Ind.—Bids will be received until Mar. 11 for paving various streets. J. Kelley, cy. clk.

Paoli, Ind.—Bids will be received Mar. 17 for constructing a gravel road in Paoli tp. Alvin B. Ham, audt.

Rockville, Ind.—Bids will be received Mar. 7, 1:30 p. m., for constructing a gravel road in Liberty tp. James. E. Elder, audt.

Wabash, Ind.—Bids will be received Mar. 7, 1 p. m., for constructing two gravel roads. J. F. Naftzger, audt.

Winamac, Ind.—Bids will be received Mar. 7, 12 m., for improving public highways. W. E. Munchenburg, audt.

Worthington, Minn.—Bids will be received Mar. 13, 2 p. m., for grading two mi. of road. Certified check, 5 per cent. E. C. Parnell, audt.

Jackson, Miss.—Bids will be received Mar. 9 for county road construction. Bond required. Mayes Cooper, highway engr.

Lorain, O.—Bids will be received Mar. 7 for furnishing material and constructing sidewalks and crosswalks, etc. L. B. Johnson, clk.

Youngwood, Pa.—Bids will be received until Mar. 13 for paving 2 mi. of street with brick blocks. Warren T. Mitchell, Greensburg, boro engr.

Ft. Monroe, Va.—Bids will be received until Mar. 21, 10 a. m., for constructing concrete walks, macadam roads, etc. Capt. R. B. McBride, Ft. Monroe, Va.

Olympia, Wash.—Bids will be received Mar. 8 for completing state aid road No. 71. State Highway Com., Olympia, Wash.

Monroe, Wis.—Bids will be received until Mar. 7 for paving 5,057 sq. yds. W. G. Kirchoffer, cons. engr.

SEWERS.

CONTRACTS TO BE LET.

Ft. Morgan, Colo.—Bids will be received Mar. 15 for the construction of pipe sewers and concrete for manholes and flush tanks. C. C. Rickel, cy. clk.

Atlanta, Ga.—Bids will be received Mar. 14 for constructing intercepting sewer and disposal plant on Intrenchment creek. City council.

Rockmart, Ga.—Bids will be received Mar. 7, 2 p. m., for furnishing material and constructing water works and sewerage system. City mayor.

Pocatello, Ida.—Bids will be received Mar. 9, 8 p. m., for constructing trunk sewers. City council.

Lebanon, Ind.—Bids will be received Mar. 13, 7:30 a. m., for graveling and constructing sewer in Baronne st. Edmund Connor, cy. clk.

Ft. Andrews (Boston P. O.), Mass.—Bids will be received Mar. 10 for extend-

ing water mains and changing the sewer at Ft. Andrews. Capt. A. M. Miller, 263 Sumner st., Boston, Mass.

Ft. Washington, Md.—Bids will be received Mar. 20 for constructing an 8-in. sewer outlet and iron outfall. Capt. R. H. C. Kelton, Ft. Washington, Md.

St. Cloud, Minn.—Bids will be received Mar. 8 for sewer construction, including the following: 19,746 lin. ft. of pipe sewer from 8 to 24-in.; 67 manholes; 67 catch basins, and 8 flush tanks. City council.

Tracy, Minn.—Bids will be received Mar. 9, 8 p. m., for sewer construction. Certified check, 15 per cent. Lester J. Fitch, cy. rec.

Bridgeton, N. J.—Bids will be received Mar. 7 for furnishing material and constructing sewage disposal plant and pumping station, etc. City council.

Grand View (Columbus P. O.), O.—Bids will be received until Mar. 21 for furnishing material for the construction of a sewer with an outlet. Vil. clk.

Moundsville, W. Va.—Bids will be received until Mar. 21 for furnishing material and constructing about 26 miles of sewers, varying in size from 6 to 36 in. Oscar B. Bonar.

WATER WORKS.

CONTRACTS TO BE LET.

Rockmart, Ga.—Bids will be received Mar. 7, 2 p. m., for furnishing material and constructing water works and sewerage system. Cy. mayor.

Owensboro, Ky.—Bids will be received Mar. 10 for constructing a water softening plant. S. Lambert, mayor.

Ft. Andrews (Boston P. O.), Mass.—Bids will be received Mar. 10 for extending water mains and changing the sewer at Ft. Andrews. Capt. A. M. Miller, 263 Sumner st., Boston, Mass.

Macomb, Miss.—Bids will be received Mar. 7 for sinking an artesian well. J. D. Harrell, cy. clk.

Hornell, N. Y.—Bids will be received Mar. 10 for constructing an earthen reservoir with concrete curve wall, etc., including 3 miles of water mains. Cy. clk.

Ogdensburg, N. Y.—Bids will be received Mar. 7 for constructing covered sand filters, pipe lines, steam and electrical pumping machinery, water turbine, etc. Board of water comrs.

Troy, N. Y.—Bids will be received Mar. 11 for furnishing material and installing water mains from the intersection of Adams st. to Miami county infirmary. A. E. Sinks, audt.

Jonesboro, N. C.—Bids will be received until Mar 13, 5 p. m., for constructing and furnishing material for water works; 385 tons of 6 to 8-in. cast-iron pipe; hydrants and specials; laying 6 miles of 6 and 8-in. pipe and erecting 75,000-gallon tower and tank. Certified check, $500. W. S. Murchison, clk.

Grand View (Columbus P. O.), O.—Bids will be received until Mar. 21 for laying water mains and water pipes within the city limits. Vil. clk.

Bristol, Pa.—Bids will be received Mar. 20 for furnishing material and constructing water works and filtration plant. Borough council.

West Telford, Pa.—Bids will be received Apr. 1 for water works construction. H. Z. Walpole.

Gettysburg, S. D.—Bids will be received Mar. 20, 7 p. m., for constructing a complete water works system. Certified check $500. Cy. audt.

Miller, S. D.—Bids will be received Mar. 3 for constructing an artesian well in the court house square. Chas. I. Odie, audt.

Seattle, Wash.—Bids will be received Mar. 7 for constructing a steel water tower on Magnolia Bluff. C. B. Bagley, sec.

BRIDGES.

CONTRACTS TO BE LET.

Los Angeles, Cal.—Bids will be received Mar. 6 for constructing concrete arches, graveled approaches, curbs, etc. H. T. Lelande, county clk.

Martinsville, Ind.—Bids will be received Mar. 7, 2 p. m., for constructing a number of arches. J. S. Whittaker, audt.

Petersburg, Ind.—Bids will be received Mar. 7, 2 p. m., for constructing a steel bridge. John D. Gray, audt.

Ida Grove, Ia.—Bids will be received Apr. 3 for plans and construction of steel bridges in Ida county. Board of supervisors.

Grasston, Minn.—Bids will be received Mar. 10, 1 p. m., for constructing a steel bridge across Rice creek. Certified check 10 per cent. Peter Backlund, town clk.

Rockport, Mo.—Bids will be received until Mar. 7 for constructing two steel high-truss bridges, 90 ft. long. Certified check, $500. Board county comrs.

Utica, N. Y.—Bids will be received until Apr. 1 for constructing a bridge over the Mohawk river. William F. Cogley, cy. engr.

Hamilton, O.—Bids will be received until Mar. 11, 10 a. m., for constructing sub and superstructure of a bridge and road fill. Certified check, 10 per cent. J. E. Brate, audt.

STREET LIGHTING.

CONTRACTS TO BE LET.

Boston, Mass.—Bids will be received Mar. 4 for furnishing and installing about 11,000 lamps in various streets, parks and alleys. Louis K. Rourke, board of public works.

Cleveland, O.—Bids will be received until Mar. 8, 12 m., for furnishing and delivering transformers for municipal electric light plant. A. B. Leo, dir. pub. serv.

FIRE APPARATUS.

CONTRACTS TO BE LET.

Princeton, N. J.—Bids will be received until July 5 for furnishing auto pumping engine. E. M. Updike, chrm. fire and water com.

Ottawa, Ont., Can.—Bids will be received until Mar. 14, 12 m., for furnishing combination auto fire engine, capacity, 700 gallons per minute. John Henderson, cy. clk.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTRACTS TO BE LET.

Woodruff Place, Ind.—Bids will be received Mar. 13, 2 p. m., for collecting and removing ashes and garbage. Carrol E. Swain, cy. clk.

McKees Rocks, Pa.—Bids will be received Mar. 13 for constructing a garbage disposal plant. City council.